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ABSTRACT

A computerized system is described which assists in collecting and processing interaction analysis data. This type of data can be a valuable source of feedback in such situations as a teachers' inservice training program. In this approach, observed behaviors are classified into one or more of 10 different categories, and a digit is assigned to describe each category. An observer uses a touch telephone data set to transmit the appropriate number code for each behavior directly to the computer. The computer analyzes this data and provides feedback to the observer in the following forms: a sequential tally of each code used, an interaction analysis frequency matrix, an interaction analysis relative-frequency matrix, a redefinition of categories, and a value for several variables derived from the frequency matrix. Examples of coding systems which have been used in "live" classroom situations are considered. Several possible applications of the data collection method to answer questions about classroom behavior are suggested. For example, a teacher might want to know whether or not he uses student ideas immediately after a student has commented or the extent to which he involves each student in discussion. Examples of a consultant's interaction with the system and cost estimates are included. (JY/MI)

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MICHIGAN-OHIO REGIONAL EDUCATIONAL LABORATORY'S COMPUTERIZATION OF INTERACTION ANALYSIS PROJECT

by

Uldis Smidchens and Rod Roth

July, 1968

Michigan-Ohio Regional Educational Laboratory
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PREFACE

The Michigan-Ohio Regional Educational Laboratory wishes to thank Uldis Smidchens and Rod Roth, co-authors of this report, for the valuable contribution they have made to the Laboratory's Inservice Teacher Training Program by developing a system which can be used not only to speed up the processing of pupil and teacher interaction data, but also to collect a greater variety of data than has been possible up to this point. In any teacher training inservice program such as the one which is being developed by MOREL, efficient feedback techniques are essential, since it would be very undesirable to make the task of looking at one's own behavior tedious. The data processing system described in this report allows the teacher and consultant to deal with topics of greatest interest to them without having to spend many hours in organizing data into a manageable form. In this project the authors have utilized modern technology to improve inservice training of teachers.

In order for the data collection and feedback system described in this report to become useful to teachers by helping them improve their teaching techniques, they must be convinced of the value of receiving objective data about their own behaviors and trained in the handling of such data. The data collection and feedback system described in this project is a part of the teacher training inservice program which has been developed by MOREL.

MOREL is indebted to the Oakland County Intermediate School District and The University of Michigan for making available their computer systems for this project. Also, MOREL appreciates the help given by the staff of the Jefferson Junior High School and of the Pontiac Public Schools in testing the data processing and feedback system described in this report.

Appreciation should also go to George Miller for his creative suggestions as to how the feedback system developed in this project could be used not only in an inservice teacher training program, but also for testing some of his ideas in live classrooms. MOREL is also very appreciative of the help given by Ned Flanders in the planning stages of this project. Many thanks should go to Dr. Marie Snider for editing this report and making some very useful suggestions.

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Stuart C. Rankin, Executive Director
Michigan-Ohio Regional Educational Laboratory

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CHAPTER I

OVERVIEW

Introduction

In some situations an observer of a group might wish to categorize the various behaviors in that group and record his decisions. This technique of categorizing human behaviors in mutually exclusive and totally inclusive categories has been used in the past in several situations (Bales, 1950; Bowers, 1961; Flanders, 1960; Whithall, 1949). Most of the present techniques utilize pencil-paper instruments. The paper-pencil techniques have the advantage of the observer being able to make corrections or any comments on the instrument. This paper-pencil technique of collecting data has some of the following disadvantages: the observer has to continually shift his eyes from the paper to the group and back; the rate of recording is limited by this shift of attention between the group and a piece of paper; and the rate at which the observer is able to receive an analysis of the data is delayed, since the written statement of the codes usually has to be transferred to a medium which can be fed into a computer. If one is using a category system which does not require more than one or two decisions for each piece of behavior, a Digitek or optically-scanned sheet might be the most economical means of recording data.

The results of this project are intended to be most useful in teachers' inservice training programs such as the one which is being developed by the Michigan-Ohio Regional Educational Laboratory (MOREL). There are many

situations in an inservice program where it is desirable to categorize the behaviors of some individuals and process the data as quickly as possible.

In this project the utility of a touch telephone which feeds data directly into a computer system is investigated. Also, the possibility of some output device such as a modified teletype which could be used in conjunction with the input device is investigated. Some computer programs are described in this report to illustrate the potential of such methods of collecting and analyzing interaction analysis data. Interaction analysis data in this project refer to any data collected through the use of category systems in which each category defines some kind of observable behavior.

Interaction analysis is a method of abstracting, collecting, and analyzing information about observable behaviors of members of a group. This abstracting is often very useful in focusing one's attention upon specific aspects of the totality of the group's behaviors. The specific aspects upon which one wishes to focus his attention constitute the most important factor which should be used to determine the category system one should use in a specific situation.

Structure of the Category Systems Permissible in This Project

A category system in this project may consist of a number of categories, each of which is labeled with a fixed number of digits. For example, if one uses a 10-category system, it is possible to use single-digit codes to label each category. However, if one uses a 22-category system, each category should be labeled with a two-digit code.

The categorization techniques permissable in this project allow one to use several category systems to label each piece of behavior. For example, one may categorize each piece of behavior in System A, System B, and

System C (see Table 1). In this case each piece of behavior would be categorized by a three-digit code. Note that in this situation one is actually using 144 categories to classify each piece of behavior.

Table 1

EXAMPLES OF CATEGORY SYSTEMS

System - A (Source of Communication)

Code	Description
1	Teacher
2	Student a
3	Student b
4	Student c
5	Other students
6	None of the above

System - B (Levels of Abstraction)

Code	Description
1	Naming of instances
2	Grouping, labeling
3	Relationships
4	Inferences, generalizing

System - C (Nature of Communication)

Code	Description
1	States own, new ideas
2	Asks question to get factual information
3	Asks question to clarify a previous point
4	Clarifies a previous point, stated by someone else
5	Clarifies a previous point, stated by self
6	None of the above

In situations where one wishes to use more than one-digit codes for each piece of behavior, one will have available only nine digits, since, in such a situation, one digit will have to be used for a special purpose described later in this report. The digit which is eliminated as a category code may be changed by the user from one data set to the next.

Overview of the Data Processing System Used in This Project

Figure 1 shows schematically the flow of information in the process of providing feedback to a teacher (or any member of a group) about the behavior of that group, where the behavior has been abstracted through the use of one or more category systems. The data processing scheme begins with an observer looking at pieces of behavior which occur in the classroom and assigning of a numerical code tc each piece of behavior. At the moment the observer has decided on the appropriate code for a section of behavior, he records this code through the use of the touch telephone. (Procedures for recording are described in Chapter II.)

The arrangement of the keys on the data input device, the touch telephone keyboard, is illustrated in the diagram below.

1	2	3
4	5	6
7	8	9
*	0	#

Each key, when depressed, sends a tone to a storage device where the data is being stored. The keys 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0 are each used to store representations of the digits 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0 respectively on the storage device (e.g., magnetic tape). In this project

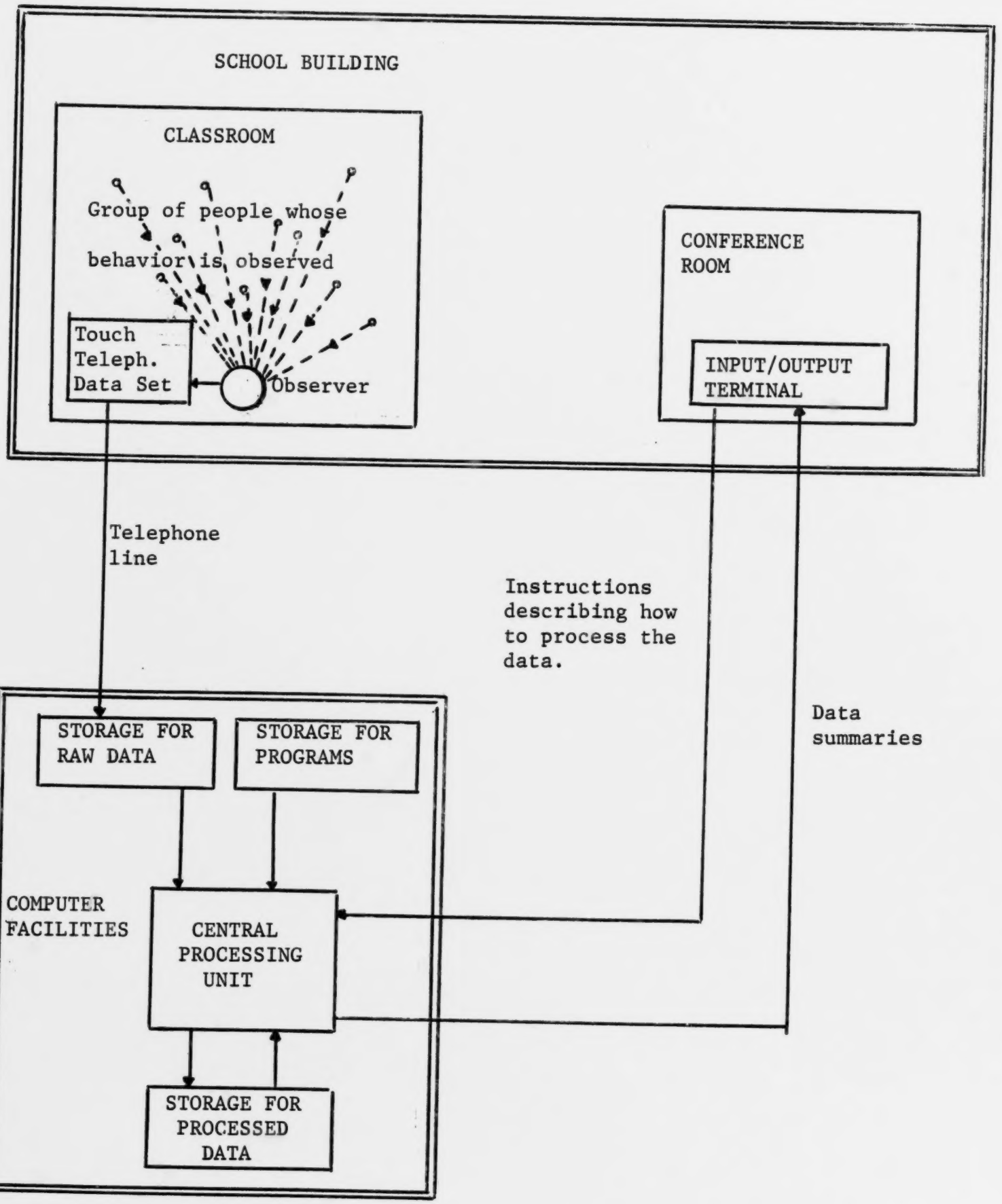

Figure 1 - Overview of the System Which May Be Used to Provide Feedback to Some Members of a Group About Their Own and the Group's Behavior.

the touch telephone in a school building is used to operate a keypunch in a computing center and, consequently, the data is being stored on data cards.

The # key is used in this project, to skip the rest of the columns of the data record (e.g., data card) in use at the moment and to ready the next data record for receiving of data. The * key is used to get the keypunch supervisor's attention. It is possible to wire the system in such a way that these keys are used for other purposes.

It should be noted that, whenever available, magnetic tapes, disks, or drums would probably serve as more convenient storage devices than would data cards. In order to utilize the procedures described in this project, it is essential that the storage facility used can receive data which have been transmitted over a telephone line.

Through the use of appropriate instructions, the raw data which have been stored in the computer system can be processed and summarized by using computer programs. These summaries may be viewed as soon as the output has been printed. The instructions needed to use the programs may be given from various input/output points of the computer system (e.g., a teletype or an input/output system using batch processing). The output, consisting of summaries or various displays of the data, can then be viewed by a consultant and/or the receiver of the feedback (e.g., teacher) at a convenient location (e.g., conference room). In this project, paper printers ranging in width from 72 to 132 characters have been used. Most of the work has been done on terminals relying on 72-character-wide paper output.

Organization of the Report

A description of the procedures for collecting data through the use of a touch telephone data set and procedures for analyzing the data from a

terminal which is part of a computer system is contained in the next chapter of this report. Chapter 3 contains several examples of the use of the data collection and feedback system developed in this project. The last chapter contains suggestions for some possible improvements in the data collection and processing system which is described in this report.

Summary

In this project a touch telephone is being used to record interaction analysis data, i.e., data collected through the use of a category system in which each category defines some kind of observable behavior. Interaction analysis also refers to any kind of analysis of such data. In this project the code labels may contain only digits. The data may be processed from an input-output terminal connected with a computing center. This permits one to process the data in the same school building in which they have been collected.

CHAPTER II

INSTRUCTIONS FOR DATA COLLECTION AND PROCESSING

Data Collection

The data collection requires the use of the touch telephone data set which has to be plugged into a telephone line outlet and into an electrical outlet in the room where the data collection is to take place. In this project the touch telephone data set consists of a dial telephone, a touch telephone keyboard, and a loudspeaker.

A. Using the dial telephone the observer should call the supervisor of the data receiving station (e.g., keypunches). This call may be made from any extension of the telephone one wishes to use.

B. The supervisor should be asked to ready for the observer the data receiving station (e.g., keypunch). This might involve setting up a program or placing on the first data record some information which will be duplicated on the remaining data records. The program for the input device should be set up in such a manner that it will allow the observer to use only the number of columns in each data record as specified in Step H. It is highly recommended that the number of columns be kept standard for a given data storage device. If magnetic tapes, discs, or drums are used for data storage, the duplication of the same information on every data record is probably not necessary since this kind of information is usually needed only to keep the records in a prescribed sequence.

C. The left plug in the telephone cradle should be pulled up. The telephone receiver should not be hung up but placed aside. If the volume from the speaker is too high, it can be turned down completely. (However, if one is making the above call from an extension, he should place the receiver aside after he finishes conversing with the supervisor, then go to the location where the data collection will take place, plug in the data set, and pull up the left plug in the telephone cradle, placing the telephone receiver aside.)

D. The observer should now be ready to start to use the touch telephone keyboard for data input.

E. The # key should be depressed once to be sure that the next digit will be recorded in the first column of a data record.

F. A two-digit code should be sent to indicate how many digits will be used to categorize a single piece of behavior. 01, 02, 03, or 04 should be used to indicate that one will be using one, two, three, or four digit codes, respectively, to label behaviors. In this project some difficulties might arise if more than three digit codes are being used.

G. A 0 (zero) should be sent.

H. One should send the two-digit numeral representing the number of columns used for the interaction analysis data on a data record (e.g., 50, 66). An integer larger than 66 should not be used.

I. A 0 (zero) should be sent.

J. One should then send the separation code, which will be used to separate one code from the next code. A code is the set of digits used to describe one piece of behavior. To illustrate the use of a separation code: Suppose that two digits are used for each code, and 0 is used for the separation code; then the following digits could be sent over the

telephone lines as interaction analysis data describing five pieces of behavior: 12013024054053. Suppose the coder makes some errors and sends the following sequence: 3203400540555067073090. Any two or more (but less than 10) consecutive separation codes (in this case 0's) are interpreted as a single zero. The 555 and the 9, each separated by a 0 (the separation code), are considered as errors and, therefore, ignored. Consequently, the coder can make a correction by sending an incorrect number of consecutive digits to describe one piece of behavior. For example, assume that the following sequence of digits has been sent: 013056089 (Two digit codes are being used, and 0 is used for a separation code.). Suppose that the coder decides that 89, the last code sent, is not the correct code. He then sends a digit which is not the separation code; he follows that digit with the separation code (e.g., 70). This procedure causes the 89 followed by the extra digit (e.g., 897) to be ignored. In case an observational scheme is used in which each piece of behavior is described by a single digit, no separation code should be used. (However, if one does want to use a separation code, a 09 instead of a 01 should be sent in step F above.)

K. One is now ready to code the behavior under observation, using the above specifications.

L. At the termination of a data set, the separation code mentioned in J above should be depressed at least 10 times. If the separation code is not being used, the # key should be depressed to skip the remainder of the present record. In this case, when single digit codes are being used and no separation code is used, one should avoid having more than 60 consecutive zeroes.

M. The # key should be depressed to get to the beginning of a new data record. In some cases this might produce a blank data record; this is not an error.

N. A 99 should be sent and the rest of the data record should be skipped by depressing the # key. For the last data set, in place of the 99, a 91 should be recorded.

O. If more data sets are to be entered, the above steps starting with step F should be repeated. If the observer wishes to have information duplicated on every data record different from the information which was duplicated on every record in the previous data set, he should call the supervisor by depressing the * key and start with step B above. Step C will not have to be repeated.

P. At the end of the job the observer might want to ring, using the * key, for the superior to give her special instructions concerning the data that had just been transmitted. If it is not necessary to give special instructions, the telephone receiver should be just hung up.

Processing of the Interaction Analysis Data from a Terminal

The data are processed in two stages. The first stage utilizes a computer program which prepares the data by searching for errors, making corrections when possible, and arranging the data in a format acceptable to computer programs used in the second stage of the data processing.

Stage One.

In this report the computer program used in this stage is referred to as "data clean-up program".

Arrangement of the Raw Data. The data clean-up program requires that the data be arranged in a specific manner in a direct access file referred

to in the program by a 1. Each of the records in this direct access file should contain 80 columns. If all has been done properly in the data collection, the data records are already arranged for processing. (The data records might still have to be stored in a direct access file.) The first record of a data set should contain, in columns 1 and 2, the number of digits used to code each piece of behavior (e.g., 01, 02, 03) and, in columns 4 and 5, the number of columns (e.g., 66) utilized on each data record for interaction analysis data. In column 7 of this first record must be the separation code (See step J in the section "Data Collection" in this chapter for definition of separation code.).

The second record of the data set should contain, in columns 1 through 76, the description of the data set which follows. The records which follow should contain in the first NC (the number specified in columns 4 and 5 of the first record of a data set) columns the interaction analysis data as transmitted through the use of the touch telephone data set. Each interaction analysis data set is terminated with at least ten consecutive separation codes. If no separation code is used, use at least 60 zeroes to terminate the interaction analysis data sequence; a blank data record will accomplish the same purpose. The data set should have a trailer data record which contains a 99 in columns 1 and 2. For the last data set of a group of data sets, instead of a 99, a 91 should be used on the trailer data record.

Flow charts of the data clean-up program. The flow charts for the data clean-up program are in Figures 2, 3, and 4. Figure 2 represents the main program, and the latter two figures represent subroutines used in the main program.

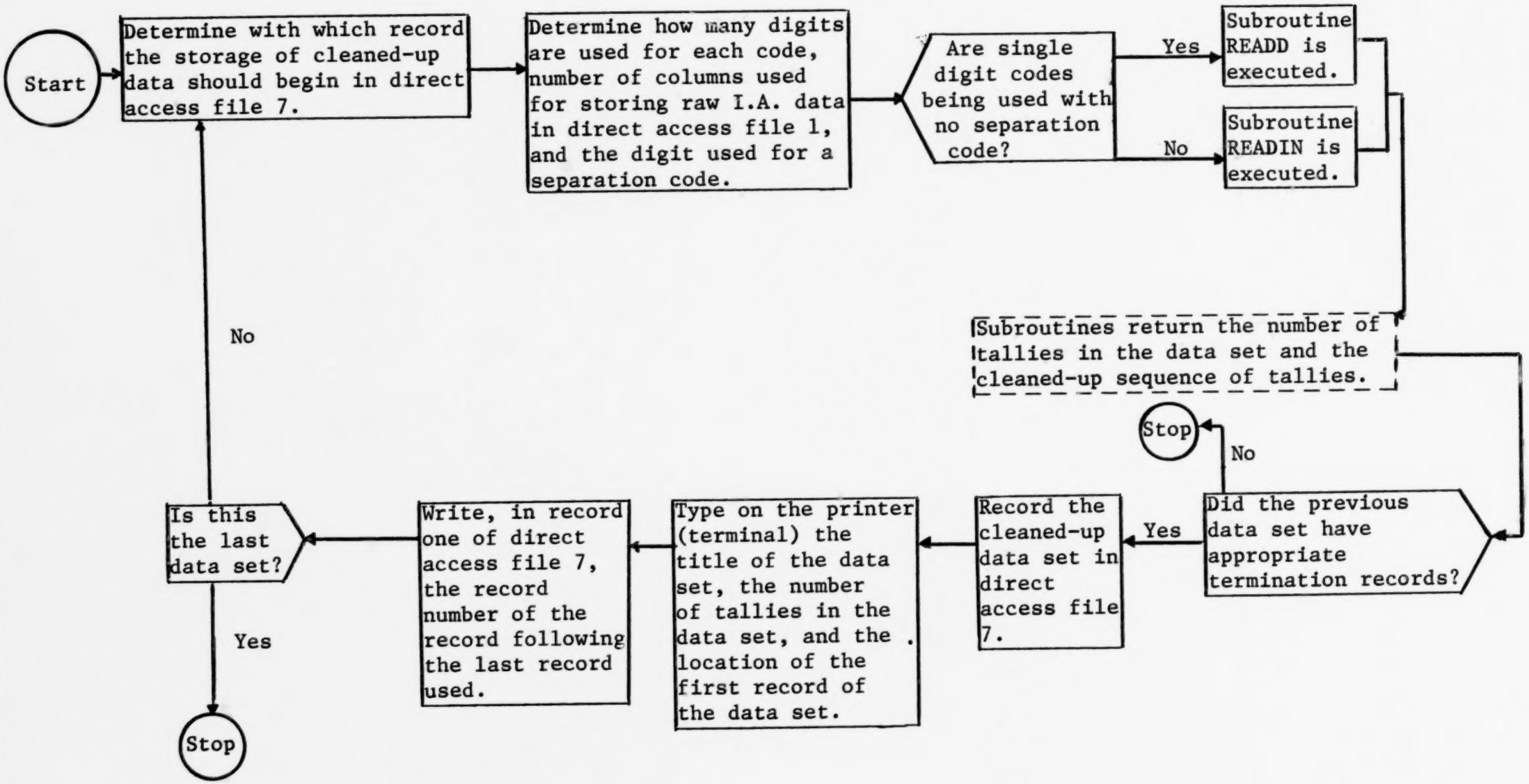
Start
Determine with which record the storage of cleaned-up data should begin in direct access file 7.
Determine how many digits are used for each code, number of columns used for storing raw I.A. data in direct access file 1, and the digit used for a separation code.
Are single digit codes being used with no separation code?
Yes
No
Subroutine READD is executed.
Subroutine READIN is executed.
Subroutines return the number of tallies in the data set and the cleaned-up sequence of tallies.
Stop
No
Did the previous data set have appropriate termination records?
Yes
Record the cleaned-up data set in direct access file 7.
Type on the printer (terminal) the title of the data set, the number of tallies in the data set, and the location of the first record of the data set.
Write, in record one of direct access file 7, the record number of the record following the last record used.
Is this the last data set?
No
Yes
Stop

Figure 2 - Flow Chart for the Main Program of the Data Clean-up Program

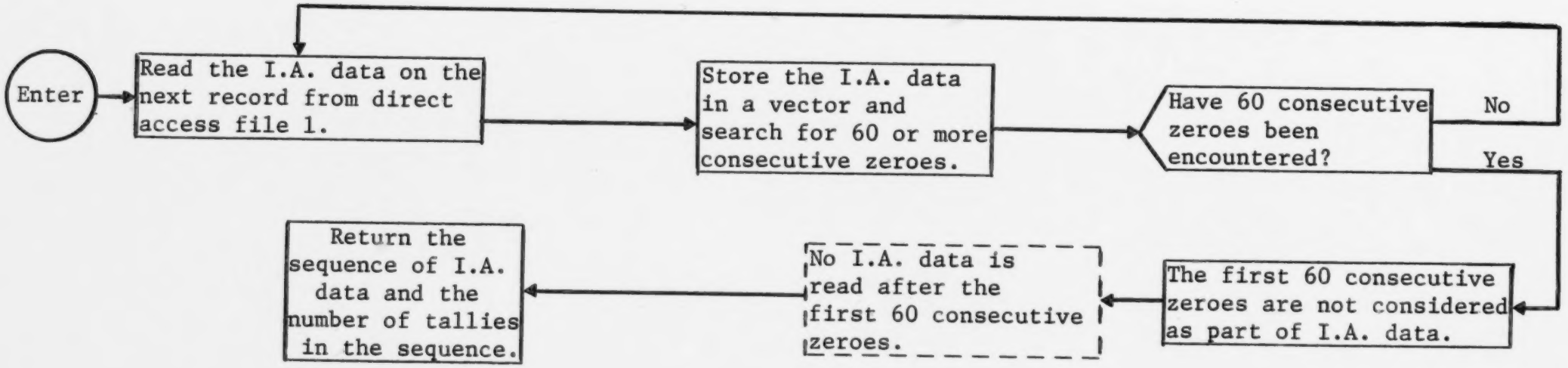
Enter
Read the I.A. data on the next record from direct access file 1.
Store the I.A. data in a vector and search for 60 or more consecutive zeroes.
Have 60 consecutive zeroes been encountered?
No
Yes
The first 60 consecutive zeroes are not considered as part of I.A. data.
No I.A. data is read after the first 60 consecutive zeroes.
Return the sequence of I.A. data and the number of tallies in the sequence.

Figure 3 - Flow Chart for the Subroutine READD Which Processes Single Digit Codes.

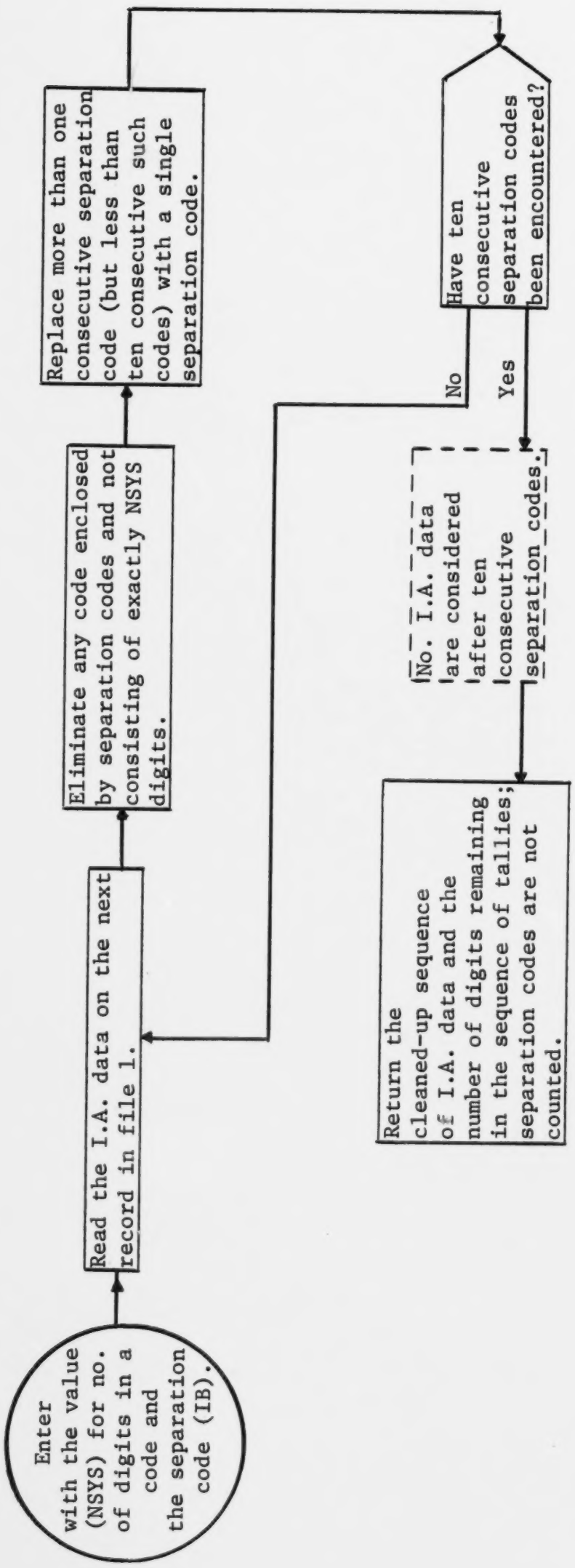
Enter with the value (NSYS) for no. of digits in a code and the separation code (IB).
Read the I.A. data on the next record in file 1.
Eliminate any code enclosed by separation codes and not consisting of exactly NSYS digits.
Replace more than one consecutive separation code (but less than ten consecutive such codes) with a single separation code.
Have ten consecutive separation codes been encountered?
No
Yes
Return the cleaned-up sequence of I.A. data and the number of digits remaining in the sequence of tallies; separation codes are not counted.
No. I.A. data are considered after ten consecutive separation codes.

Figure 4 - Flow Chart for the Subroutine READIN Which Processes Data in Which Separation Codes Have Been Used.

The data clean-up program. The program itself has been written in Fortran IV (IBM, 1966) and is listed below.

```
C                DATA-CLEAN-UP PROGRAM
CDIRECT ACCESS FILE 1  CONTAINS RAW DATA.  THE DATA IN THIS FILE ARE
C                ARRANGED IN THE FOLLOWING ORDER.  THE FIRST RECORD OF EACH
C                DATA SET CONTAINS IN THE SECOND COLUMN THE VALUE FOR NSYS
C                AND COLUMNS 4 AND 5 CONTAIN THE VALUE FOR NC AND IN COLUMN 7
C                THE SYMBOL FOR IB.  THE SECOND RECORD OF EACH DATA SET
C                CONTAINS THE TITLE OF THE DATA SET.  THE FOLLOWING RECORDS
C                CONTAIN THE TALLIES IN THE FIRST NC COLUMNS.  EACH DATA SET
C                TERMINATES WITH AT LEAST TEN IB SYMBOLS AND THE LAST RECORD
C                IS A BLANK ONE EXCEPT FOR A 91 OR A 99 IN COLUMNS 1 AND 2.
C                99 INDICATES THAT THIS IS NOT THE LAST DATA SET TO BE READ,
C                WHILE A 91 INDICATES THAT THIS IS THE LAST DATA SET TO BE
C                READ.
CDIRECT ACCESS FILE 7  CLEANED UP DATA IS BEING STORED IN THIS FILE IN THE
C                FOLLOWING ORDER.  FIRST RECORD OF A DATA SET CONTAINS THE
C                TITLE OF THAT SET AND THE NUMBER OF SINGLE DIGIT CODES IN
C                THAT SET.  THE FOLLOWING RECORDS CONTAIN IN THE FIRST 66
C                COLUMNS THE CLEANED UP CODES.  THE LAST RECORD OF A DATA
C                SET IS A BLANK RECORD EXCEPT THAT COLUMNS 67 AND 68 CONTAIN
C                A 99.  THE FIRST RECORD IN THIS FILE IS ALWAYS TO CONTAIN IN
C                THE FIRST FOUR COLUMNS THE RECORD NUMBER AT WHICH THE
C                STORING OF ANY ADDITIONAL DATA IS TO BEGIN.  IF A NEW FILE
C                IS STARTED, USUALLY A 0002 SHOULD BE PRE STORED IN THIS FIRST
C                RECORD.
CDEVICE 6        PRINTER USED FOR SOME GENERAL COMMENTS.
CICARD           LINE NUMBER FOR FILE 1.
CILINE           LINE NUMBER FOR FILE 7.
CNSYS            NUMBER OF SYSTEMS USED IN CODING ONE PIECE OF BEHAVIOR.
CITITEL          TITLE OF A DATA SET
CISEQ            VECTOR CONTAINING THE CLEANED UP DATA.
CN               NUMBER OF TALLIES STORED IN ISEQ.
CICONT           THE NUMBER ON THE RECORD WHICH FOLLOWS A DATA SET LAST READ
C                IN FILE 1.
CIST             THE NUMBER STORED IN THE FIRST RECORD OF FILE 7.
CREADD           SUBROUTINE FOR READING ONE DIGIT TALLIES RECORDED CONSECUTIVELY.
C                IN LAST RECORD OF A DATA SET SHOULD BE A BLANK ONE EXCEPT
C                COLUMNS ONE AND TWO SHOULD CONTAIN A NUMBER INDICATING
C                WHETHER THIS IS THE LAST DATA SET TO BE READ OR THAT THERE
C                ARE MORE DATA SETS TO BE CLEANED UP.
CIZ              THE CODES AS THEY ARE READ FROM FILE 1.
CIBLANK          NUMBER OF CONSECUTIVE IB CODES AT THE LAST MOMENT OF READING
C                THE DATA CARD.
CREADIN          SUBROUTINE FOR READING FROM FILE 1 TALLIES SEPARATED BY THE
C                SYMBOL STORED IN IB.  IF NO ERROR IS MADE EVERY SET OF NSYS
C                SINGLE DIGIT CODES ARE SEPARATED BY THE IB SYMBOL.  ANY SET
C                OF MORE THAN OR LESS THAN NSYS CONSECUTIVE TALLIES NOT
C                INCLUDING THE IB SYMBOLS ARE IGNORED.  MORE THAN ONE
C                CONSECUTIVE IB SYMBOLS ARE INTERPRETED AS JUST ONE IB SYMBOL.
C                THE LAST RECORD OF A DATA SET IS A BLANK ONE EXCEPT FOR A
```

```
C               NUMBER IN THE FIRST TWO COLUMNS INDICATING WHETHER OR NOT
C               THIS IS THE LAST DATA SET OF A SEQUENCE OF DATA SETS TO BE
C               READ BY THIS PROGRAM
CISIG           NUMBER OF CONSECUTIVE TALLIES (NOT INCLUDING IB SYMBOLS) AT
C               A PARTICULAR MOMENT IN THE READING PROCESS.
CIB             CONTAINS SYMBOL USED TO SEPARATE CODES OR TO INDICATE ERROR
C               IN PREVIOUS CODES.
CNC             MAXIMUM NUMBER OF COLUMNS USED IN EACH RECORD IN FILE 1 FOR
C               THE CODES.  THIS NUMBER MAY NOT EXCEED 66.
    1   DEFINE FILE 1(600,80,E,ICARD), 7(600,80,E,ILINE)
        COMMON IB, NC, ICARD
    2   DIMENSION ISEQ(5000), ITITEL(20)
        ICARD=1
    3   READ(7'1,305) IL
  305   FORMAT(I4)
        ILINE=IL+1
    4   READ(1'ICARD,306) NSYS, NC, IB
  306   FORMAT(I2,1X,I2,1X,I1)
        IF (NSYS-0) 4,4,5
    5   READ(1'ICARD,43)(ITITEL(I),I=1,19)
   43   FORMAT(19A4)
        LENGTH=0
    6   IF(NSYS-1)37,38,37
   38   CALL READD(ISEQ,N)
    7   GO TO 39
   37   IF(NSYS-9)8,16,8
   16   NSYS=1
    8   CALL READIN(NSYS,ISEQ,N)
   39   WRITE(7'ILINE,303)(ISEQ(I),I=1,N)
  303   FORMAT(66I1)
  308   READ(1'ICARD,307) ICONT
  307   FORMAT (I2)
        LENGTH=LENGTH+1
        IF(LENGTH-5) 312,312,310
  312   IF(ICONT-0)308,308,309
  309   IF(ICONT-89) 310,310,9
  310   WRITE(6,311) (ITITEL(I), I=1,19), ICARD
  311   FORMAT ('0ERROR IN DATA SET SEPERATION, SEE DATA SET  ',19A4,' LIN
       1E',I5)
        GO TO 13
    9   WRITE(7'ILINE,304)
  304   FORMAT(66X,'99')
   15   IST=ILINE
   10   WRITE(7'IL,302)(ITITEL(I),I=1,19),N
  302   FORMAT(19A4,I4)
        WRITE(6,21)(ITITEL(I),I=1,19),N,IL,NSYS
   21   FORMAT('0DATA SET WITH TITLE'/' ',5X,15A4/' ',4A4/' ',5X,
       1'WITH ',I5,'SINGLE DIGIT TALLIES IS LOCATED AT RECORD NO.'/
       2' ',5X,I5,': EACH CODE HAS',I2,'DIGITS')
   11   WRITE(7'1,305) IST
   14   IF(ICONT-99)13, 3,13
```

```
 13   CONTINUE
      STOP
      END
      SUBROUTINE READD(ISEQ,N)
      DIMENSION IZ(80), ISEQ(5000)
      COMMON IB, NC, ICARD
 119  IBLANK=0
      ISIG=0
      N=0
 106  READ(1'ICARD,111)(IZ(I),I=1,NC)
 111  FORMAT(66I1)
      IT=ICARD
 203  CONTINUE
      DO 104 I=1,NC
 204  IF(IZ(I)-IB)109,1,109
 1    IBLANK=IBLANK+1
      IF(IBLANK-10)118,105,105
 109  IBLANK=0
 118  N=N+1
      ISEQ(N)=IZ(I)
 104  CONTINUE
      GO TO 106
 105  N=N-IBLANK
 117  RETURN
      END
      SUBROUTINE READIN(NSYS,ISEQ,N)
      COMMON IB, NC, ICARD
      DIMENSION IZ(80), ISEQ(5000)
      IBLANK=0
      ISIG=0
      N=0
 106  READ(1'ICARD,111)(IZ(I),I=1,NC)
 111  FORMAT(66I1)
      DO 104 I=1,NC
      IF(IZ(I)-IB)109,11,109
 11   IBLANK=IBLANK+1
      IF(IBLANK-1)103,102,103
 102  IF(NSYS-ISIG)116,115,116
 116  N=N-ISIG
 115  ISIG=0
      GO TO 104
 103  IF(IBLANK-10) 104,105,105
 109  N=N+1
      ISEQ(N)=IZ(I)
      ISIG=ISIG+1
      IBLANK=0
 104  CONTINUE
      GO TO 106
 105  GO TO 117
 117  RETURN
      END
```

Specifications To Use the Data Clean-up Program. When using this program, the user should specify what devices in his situation are going to be used in place of the device numbers in the computer program. In this program, device 1 should be defined as a direct access file which contains the raw data arranged as described previously (e.g., Figure 5). In Figure 5 the integers on the left side are record numbers. Device 7 should be defined as a direct access file into which the cleaned-up data is to be placed. The first record of this file should contain, in the first four columns, the identification number (which should be an integer) for the record with which additional data storage should begin. Usually, when a new file is started, this number will be 0002 since the second record is the first one available for data storage. At the end of the job the program automatically places in the first four columns of the first record of the file the record number following the last record used. Device 6 in this computer program should be defined as a sequential output device (e.g., printer at a terminal). The records in all of the direct access files should be 80 columns (characters) long.

Appearance of the Output. Each cleaned-up data set as stored in the direct access file with reference number 7 begins with a record containing the data set title and, in the last four columns (77-80) of that record, the number of single digit codes in this data set. The interaction analysis data are being stored in columns 1-66 of each record between the title and the terminal record, which is blank except for a 99 in columns 67 and 68. The interaction analysis tallies are being stored in consecutive columns with the separation codes (if any were used) deleted. For identification purposes the title should contain information pertaining to the types of category systems used in the data set that is being described.

95	0306600	
96	33333333333333333333	000
97	439045204250439043904390199019931204234231990199469 469046903120 32	000
98	10321032103790379053205320469037903790379037903790199036901995 3903	000
99	41031503250425037904250352042904520429037935203520352035203520352035 23	000
100	52035203520325032531903190521019901990469046904694690379379035135 1	000
101	47947901993510532053205210521052105210412041552905290493049304920 0	000
102	0000000000	
103	99	000
104	0206600	
105	22222222222222222222	001
106	12011011011011012011011011011011011011011011092092091091092092092 0	001
107	92092092092092092091091091059059059059041041081081059059091091062 0	001
108	62092092059059059059059059092092092092092092092092091059059041041 0	001
109	41082082011011011092092092092092092092092092012012012012012012092092092 0	001
110	92092041041081081032032059059042042081081082091091032032034034034 0	001
111	59059059059059059059059059059059059059042042042082082082059059042042 0	001
112	42091091091021021091091091091022023034034032081081081022059059059 0	001
113	59059059059061061091092092074074074061061062062062062011011011011 0	001
114	92092092092061061061011011092092071071073074074000120120120120590 5	001
115	90590590590590430430430820820820310820820820320320320340340340340 5	001
116	05905905905905905905905905905905905905905905905905905905905905905 9	001
117	04204208108108108103303303305905905905905905905905905905905905905 9	001
118	59061061061061061061061061061011011011011092092092092092092092092 0	001
119	12012012012074074074074074074061061011011011059059041081041081041 0	001
120	41081042031081041081043043081081082882082023023034034034059059059 0	001
121	59059059059059059062062092092092091091091091091022022061061061061011 0	001
122	11011011011011011011011011011011011012012012012012012012012000000000000 0	001
123	91	001

Figure 5 - An Example of Two Raw Data Sets Stored in a Direct Access File

```
1    21
2    333333333333333333333
3    439452425439439439199469469312321321321379379532532469379379379379    000    177
4    37919936934131532542537942535242945242935235235235235235232531952 1
5    19919946946953253252152152152141252949349349 2
6
7    22222222222222222222                                                  99
8                                                                          001    730
9    12111111111211111111111111111111929291919292929292929292919191595 9
10   59594141818159599191626292925959595959599292929292929292915959414 1
11   41828211111192929292929292921212121212929292923241418181323259594 2
12   42313182919132323434345959595959595959595959424242828282595942 42
13   42919191212191919191222334343281818122595959595959595961619192927474
14   74616162626262111111111929292926161611111929271717374741212121259 59
15   59595959434343828282318282823232323434343459595595959595959595959595991
16   91917331595959595959424281818181333333559595959595959595959595959596161
17   61616161616161111111111929292929292929212121212747474747474611611111
18   11115959418141614181428181418143439181822323343434595955959595953 9
19   59526292929191919191222261616161111111111111111111111111112121212121 2
20   1212
                                                                           99
```

Figure 6 - An Example of Two Cleaned-up Data Sets Stored in a Direct Access File

Figure 6 shows an example of two cleaned-up data sets. Note that 21, which identifies the first unused record, is stored in the first record. A table of contents, (e.g., Figure 7) containing data set titles, the record number at which each title is located, the number of digits used to categorize each piece of behavior, and the total number of single-digit tallies in the data set is being printed by the terminal as the data is being processed.

```
DATA SET WITH TITLE
     33333333333333333333
        000
     WITH 177 SINGLE DIGIT TALLIES IS LOCATED AT RECORD NO. 2;
          EACH CODE HAS 3 DIGITS

DATA SET WITH TITLE
     22222222222222222222
        001
     WITH 730 SINGLE DIGIT TALLIES IS LOCATED AT RECORD NO. 7;
          EACH CODE HAS 2 DIGITS
```

Figure 7 - An Example of a Table of Contents for Cleaned-up Data Stored in a Direct Access File

Stage Two

This stage of the data processing consists of the use of any computer programs for analyzing the cleaned-up data which were the result of stage one in the data processing. Before using any program to analyze the data, the user should know exactly what questions he wished to get answered. The user should familiarize himself with the types of outputs the various programs can produce and the kinds of questions that can be answered by the programs. To accomplish this, it is very important that the user carefully study the nature of the input he will have to provide to the computer in order to use a given computer program. One should note that the output will be only as good as the input.

Types of Output Available. The program described in this section is the "interaction analysis matrix computer program for use at terminals" and is referred to as such in this report. The types of output that this program

can produce are described below:

A. Sequential output. The tallies under consideration are printed in a sequence with 20 codes on one line. An example of this output is in Figure 8.

```
22222222222222222222
       001     ; TOTAL NUMBER OF TALLIESIS  365
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0 92 92 91 91 92
92 92 92 92 92 92 92 92 91 91 91  0  0  0  0  0  0 81 81  0
 0 91 91  0  0 92 92  0  0  0  0  0  0 92 92 92 92 92 92 92
92 91  0  0  0  0  0 82 82  0  0  0 92 92 92 92 92 92 92 92
 0  0  0  0  0 92 92 92 92 92  0  0 81 81 32 32  0  0  0  0
81 81 82 91 91 32 32 34 34 34  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0 82 82 82  0  0  0  0  0 91 91 91  0  0 91 91
91 91  0  0 34 34 32 81 81 81  0  0  0  0  0  0  0  0  0  0
91 92 92  0  0  0  0  0  0  0  0  0  0  0  0  0  0 92 92 92 92
 0  0  0  0  0 92 92  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0 82 82 82 31 82 82 82 32 32 32 34 34 34 34  0
 0  0  0  0  0  0  0  0  0  0 91 91 91  0 31  0  0  0  0  0
 0  0  0 81 81 81 81 33 33 33  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0 92 92 92 92 92
92 92 92  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0 81  0 81  0 81  0 81 81  0 81  0  0 81 81 82  0  0 34
34 34  0  0  0  0  0  0  0  0  0  0  0 92 92 91 91 91 91 91
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0
```

Figure 8 - An Example of a Sequential Output

B. An interaction analysis frequency matrix. This matrix may not be larger than 24 columns by 24 rows, not including the row and column totals. This large a matrix is possible only on a page 132 characters wide. On a 72 character wide page only a 12-column matrix may be used. Each column in the matrix contains five characters. An example of this type of output is given in Figure 9.

C. An interaction analysis relative-frequency matrix. The limitations imposed on the frequency matrix also apply in this situation. An example of this output is given in Figure 10.

2222222222222222222
FREQUENCY MATRIX

CAT	31	32	33	34	81	82	91	92	0	
31	0	0	0	0	0	1	0	0	1	2
32	0	4	0	2	1	0	0	0	1	8
33	0	0	2	0	0	0	0	0	1	3
34	0	1	0	8	0	0	0	0	3	12
81	0	1	1	0	10	2	0	0	7	21
82	1	1	0	0	0	7	1	0	3	13
91	0	1	0	0	0	0	16	2	7	26
92	0	0	0	0	0	0	4	41	7	52
0	1	0	0	2	10	3	5	9	197	227
TOT	2	8	3	12	21	13	26	52	227	364

Figure 9 - An Example of a Frequency Matrix

2222222222222222222
RELATIVE FREQUENCY MATRIX

CAT	31	32	33	34	81	82	91	92	0	
31	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.5
32	0.0	1.1	0.0	0.5	0.3	0.0	0.0	0.0	0.3	2.2
33	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.3	0.8
34	0.0	0.3	0.0	2.2	0.0	0.0	0.0	0.0	0.8	3.3
81	0.0	0.3	0.3	0.0	2.7	0.5	0.0	0.0	1.9	5.8
82	0.3	0.3	0.0	0.0	0.0	0.0	1.9	0.3	0.8	3.6
91	0.0	0.3	0.0	0.0	0.0	0.0	4.4	0.5	1.9	7.1
92	0.0	0.0	0.0	0.0	0.0	0.0	1.1	11.3	1.9	14.3
0	0.3	0.0	0.0	0.5	2.7	0.8	1.4	2.5	54.1	62.4
TOT	0.5	2.2	0.8	3.3	5.8	3.6	7.1	14.3	62.4	100.0

Figure 10 - An Example of a Relative-Frequency Matrix

D. Redefinition or collapsing of categories. In the process of analysis any category may be redefined. This permits collapsing of categories. For example, if one wishes at a specific moment to look at only 8 categories out of 125 categories, it is possible to do it.

E. If one uses Flanders' (1960) ten categories (see Appendix A), one has the option of getting the values for various variables derived from the frequency matrix. The definitions of these variables are in Appendix B.

Flow-charts of the Interaction Analysis Matrix Computer Program for Use at Terminals. The flow chart for the main program is in Figure 11. The flow chart for one of the more essential subroutines (MATRIX) used in the main program is in Figure 12.

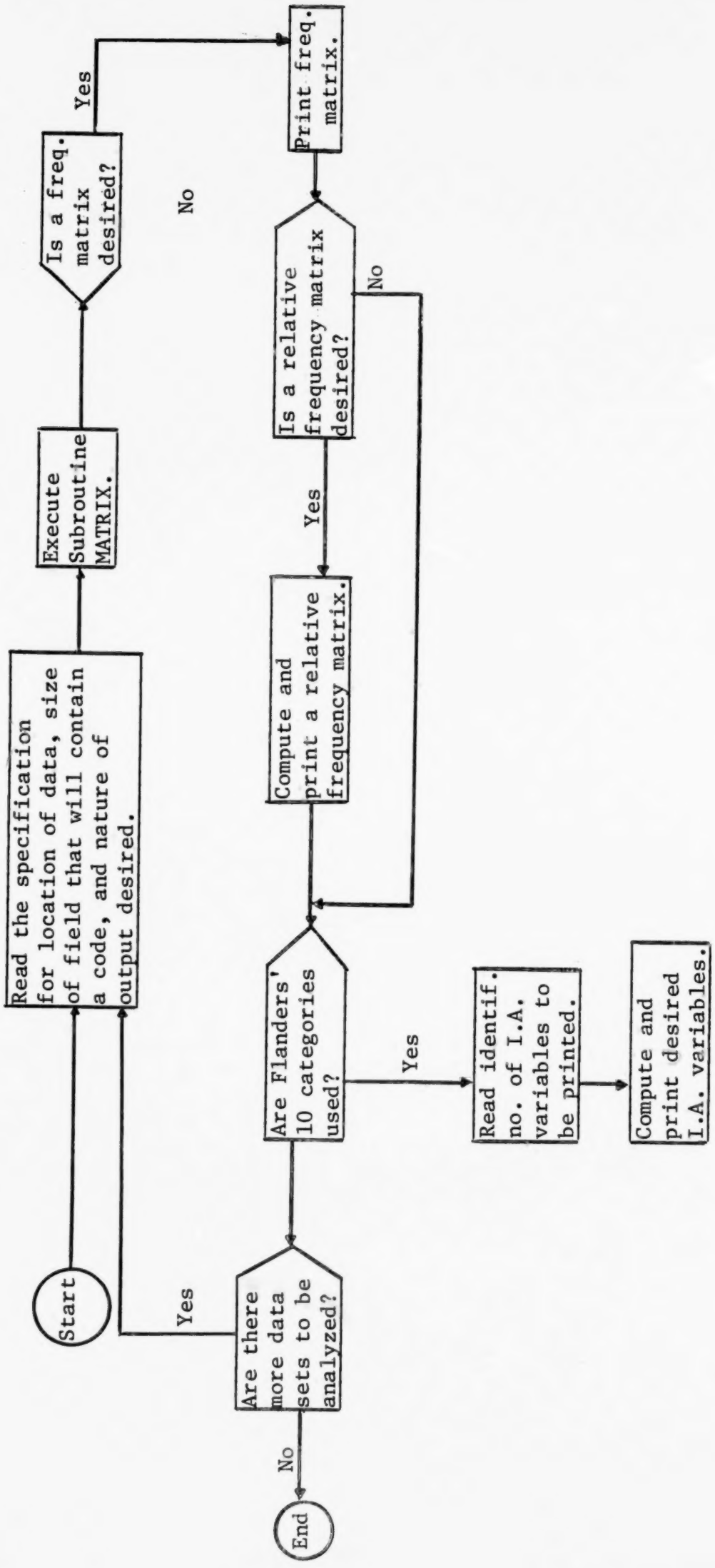
Start
Read the specification for location of data, size of field that will contain a code, and nature of output desired.
Execute Subroutine MATRIX.
Are there more data sets to be analyzed?
Yes
No
End
Is a freq. matrix desired?
Yes
No
Print freq. matrix.
Is a relative frequency matrix desired?
Yes
No
Compute and print a relative frequency matrix.
Are Flanders' 10 categories used?
Yes
Read identif. no. of I.A. variables to be printed.
Compute and print desired I.A. variables.

Figure 11 - Flow Chart for the Main Program of the Interaction Analysis Matrix Computer Program for the Terminal.

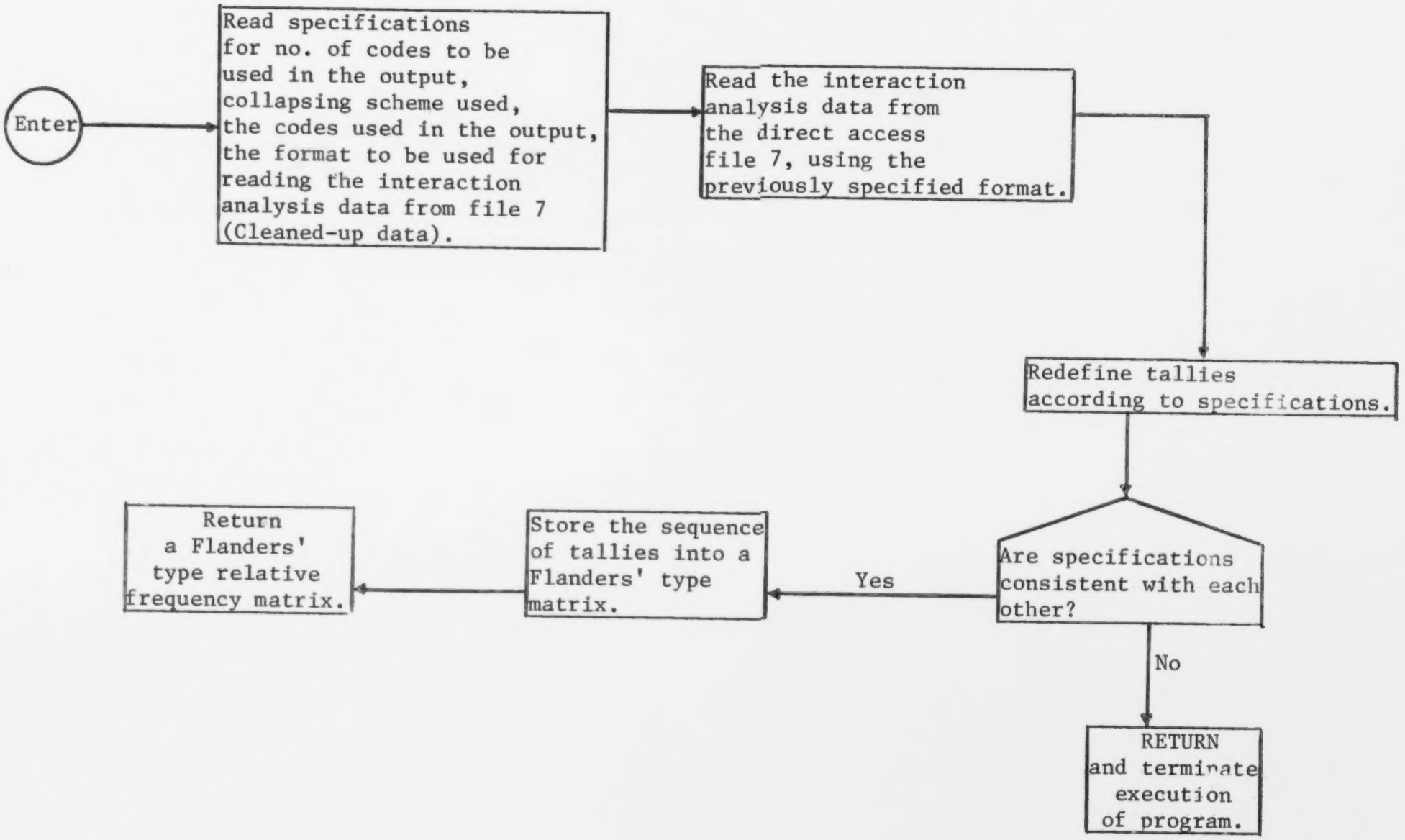
Enter
Read specifications for no. of codes to be used in the output, collapsing scheme used, the codes used in the output, the format to be used for reading the interaction analysis data from file 7 (Cleaned-up data).
Read the interaction analysis data from the direct access file 7, using the previously specified format.
Redefine tallies according to specifications.
Are specifications consistent with each other?
Yes
No
Store the sequence of tallies into a Flanders' type matrix.
Return a Flanders' type relative frequency matrix.
RETURN and terminate execution of program.

Figure 12 - Flow Chart for the Subroutines MATRIX Which is Used to Compile the Interaction Analysis Data into a Flanders' Type Matrix.

The Interaction Analysis Computer Program for Use at Terminals. The program itself has been written in Fortran IV (IBM, 1966) and is listed below.

```
C          INTERACTION ANALYSIS MATRIX PROGRAM
CDEFINITIONS OF VARIABLES IN THE INTERACTION ANALYSIS PROGRAM
CDEVICE 5  SEQUENTIAL INPUT READER (E.G., THE TERMINAL).
CDEVICE 6  PRINTER.
CDIRECT ACCESS FILE 7    THE CLEANED UP DATA IS BEING STORED IN THIS FILE.
CIM        FREQUENCY MATRIX FOR THE DATA.
CFOR       CONTAINS FORMAT ACCORDING TO WHICH DATA IS TO BE READ.
CIA        CONTAINS CODES WHICH WILL BE USED IN THE OUTPUT.
CITITLE    TITLE OF A DATA SET.
CRFIM      RELATIVE FREQUENCY MATRIX.
CIL        THE LINE NUMBER IN THE FILE AT WHICH POINT THE DATA SET TO BE READ BEGINS
C          (THE FIRST CARD IS INTERPRETED AS A TITLE CARD).
C          IF IL IS SET -1, THE JOB IS TERMINATED.
CIFIEL     THE NUMBER OF COLUMNS FROM THE FIRST DIGIT OF A TALLY ON AN IA DATA
C          CARD UP TO THE (BUT NOT INCLUDING) FIRST DIGIT OF THE FOLLOWING TALLY.
C          (E.G. IF THE FORMAT USED IS (33(I1,1X)), IFIEL IS 2, IF THE FORMAT USED
C          IS (66I1), IFIEL IS 1).
CJCONT     IF JCONT IS 1, THERE IS AT LEAST ONE MORE SET OF SPECIFICATION CARDS
C          THAT WILL FOLLOW THIS ONE.  IF JCONT IS 0, THERE ARE NO MORE SETS OF
C          SPECIFICATION CARDS THAT FOLLOW THIS SET.
CIMATRI    IF IMATRI IS 1, A PRINTOUT OF A FREQUENCY MATRIX IS DESIRED.  IF
C          IMATRI IS 0,
C          NO PRINTOUT OF A FREQUENCY MATRIX IS DESIRED.
CIRELF     IF IRELF IS 1, A PRINTOUT OF A RELATIVE FREQUENCY MATRIX IS DESIRED.
C          IF IRELF IS 0, A PRINTOUT OF A RELATIVE FREQUENCY MATRIX IS NOT DESIRED.
C          IF IRELF IS 2, IT IS ASSUMED THAT INTERACTION ANALYSIS USING FLANDERS TEN
C          CATEGORIES IS USED.  THE 2 WILL ALLOW SUBROUTINE  SAMPH TO BE USED.
CMATRIX    A SUBROUTINE WHICH COMPILES THE DATA IN A FREQUENCY MATRIX IM WITH
C          ROW AND COLUMN TOTALS.
CNECOD     NUMBER OF CODES STORED IN IA.
CPRINTI    SUBROUTINE PRINTING THE FREQUENCY MATRIX.
CPRINTF    SUBROUTINE PRINTING THE RELATIVE FREQUENCY MATRIX.
CIR        CODE IN IR(J+1) IS TO BE INTERPRETED AS THE CODE IN IR(J) WHERE J IS AN
C          ODD NUMBER.
CNCOL      NUMBER OF CODES WHICH WILL BE PLACED INTO SOME OTHER CODE
C          TIMES TWO (I.E. NUMBER OF CODES
C          STORED IN IR).
CICOLAP    IF ICOLAP IS 1, SOME KIND OF REASSIGNMENT (OR REINTERPRETATION OF
C          CODES WILL TAKE PLACE).
CN         IN STATEMENT 52 THE NUMBER OF SINGLE DIGIT TALLIES IN THIS DATA SET.
CNN        NUMBER OF CODES (ONE DIGIT, TWO DIGIT, OR THREE DIGIT, WHATEVER IS USED
C          IN THIS DATA SET).
CIPA       THIS VECTOR IS USED FOR CONVENIENCE IN PROGRAMMING FOR NUMBERING THE
C          CODES USED FROM ONE THROUGH NECOD.
CIS        VECTOR INTO WHICH IS READ THE SEQUENCE OF CODES STORED IN FILE 7, USING
C          THE FORMAT STORED IN FOR.
CRELF      SUBROUTINE USED TO CALCULATE THE RELATIVE FREQUENCY MATRIX FROM THE
C          FREQUENCY MATRIX.
CSAMPH     SUBROUTINE WHICH CALCULATES AND PRINTS 46 DIFFERENT VARIABLES FROM A
C          RELATIVE FREQUENCY MATRIX BASED ON FLANDERS 10 CATEGORIES.
```

```
      DEFINE FILE 7(600,80,E,ILINE)
      COMMON ICARD, ILINE, N
      DIMENSION IM(27,27), FOR(20), IA(30), ITITLE(20), RFIM(27,27)
      ILINE=2
   11 ICARD=1
    4 CONTINUE
      DO 10 I=1,27
      DO 10 J=1,27
   10 IM(I,J)=0
  100 IL=0
      IFIEL=0
      JCONT=0
      IMATRI=0
      IRELF=0
  121 WRITE(6,113)
  113 FORMAT('1TYPE THE SPECIFICATION FOR IL (E.G. 0002)')
      READ(5,200)IL
  200 FORMAT(I4)
      IF(IL-0)106,21,21
   21 WRITE(6,201)
  201 FORMAT('0TYPE THE SPECIFICATION FOR IFIEL(E.G. 4)')
      READ(5,202)IFIEL
  202 FORMAT(I1)
      WRITE(6,203)
  203 FORMAT('0TYPE THE SPECIFICATION FOR JCONT(E.G. 1)')
      READ(5,204)JCONT
  204 FORMAT(I1)
      WRITE(6,205)
  205 FORMAT('0TYPE THE SPECIFICATION FOR IMATRI(E.G. 1)')
      READ(5,206)IMATRI
  206 FORMAT(I1)
      WRITE(6,207)
  207 FORMAT('0TYPE THE SPECIFICATION FOR IRELF(E.G. 2)')
      READ(5,208)IRELF
  208 FORMAT(I1)
  123 IF(IL-0)106,6,5
    5 IF(JCONT-3)12,6,6
   12 ILTIF=IL
    6 WRITE(6,114)
  114 FORMAT('0TYPE THE FORMAT THAT IS TO BE USED TO READ THE DATA'/'
     1START IN COLUMN ONE: USE I-FIELDS FOR CODES TO BE READ AND'/
     2'   X FOR FIELDS TO BE SKIPPED; E.G.,(33(I1,1X))')
  124 READ(5,101)(FOR(I),I=1,20)
  101 FORMAT(20A4)
    7 WRITE(6,111)(FOR(I),I=1,20)
  111 FORMAT('0FORMAT USED TO READ THE RECORDS IN THE DATA FILE'/' ',
     120A4)
    8 IF(IMATRI-1) 104,103,106
  104 IF(IRELF-1) 105,102,103
  103 CALL MATRIX(IM,FOR,IFIEL,NECOD,IA,ITITLE)
  125 IF(IFIEL-0)105,105,115
  115 IF(IL-0)106,106,9
```

```
    9   IF(IMATRI-1) 108,107,106
  107 CALL PRINTI(IM,NECOD,IA,ITITLE)
  108 IF(IRELE-1) 105,109,109
  109 CALL RELF(IM,NECOD,RFIM)
  110 CALL PRINTF(RFIM,NECOD,IA,ITITLE)
  126 IF(IRELE-1) 105,105,112
  112 CALL SAMPH(RFIM)
  105 IF(JCONT-1) 106,  4, 11
  106 CONTINUE
      STOP
      END
      SUBROUTINE MATRIX(IM,FOR,IFIEL,NECOD,IP,ITITLE)
    2 COMMON ICARD, ILINE, N
      DIMENSION IM(27,27),FOR(20),IA(30),ITITLE(20),IPA(1001),IS(2000),
     1IR(200),IP(30)
      DIMENSION JS(2000)
    5 NECOD=0
      ICOLAP=0
      NCOL=0
      WRITE(6,402)
  402 FORMAT('0TYPE THE SPECIFICATION FOR NECOD (E.G. 10 OR 08)')
      READ(5,440)NECOD
  440 FORMAT(I2)
      WRITE(6,441)
  441 FORMAT('0TYPE THE SPECIFICATION FOR ICOLAP:'/
     1' ',5X,'TWO COLUMNS SHOULD BE USED (E.G.00,01,OR-1)')
      READ(5,442)ICOLAP
  442 FORMAT(I2)
      IF(ICOLAP-1)452,451,452
  451 WRITE(6,443)
  443 FORMAT('0TYPE THE SPECIFICATION FOR NCOL(E.G. 08 OR 12)')
   83 READ(5,444)NCOL
  444 FORMAT(I2)
  452 WRITE(6,445)
  445 FORMAT('0TYPE THE SPECIFICATION FOR IA(THE CATEGORIES'/'
     1TO APPEAR IN THE OUTPUT)(E.G. 001 003 008 010 011 555):'/
     1' IMPORTANT: IN EACH OF THE LINES THE CODES SHOULD'/
     1' START IN THE SECOND COLUMN;'/
     2' DO NOT TYPE MORE THAN 10 CODES ON ONE LINE'/
     3' IF YOU USE MORE THAN 10 CODES, TYPE ON EACH LINE EXACTLY'/
     4' 10 CODES EXCEPT ON THE LAST LINE;EACH CODE SHOULD'/
     5' CONSIST OF THREE DIGITS, A SPACE BETWEEN EACH CODE')
      READ(5,446)(IA(I),I=1,NECOD)
  446 FORMAT(10I4)
      MECOD=NECOD
      DO 401 I=1,NECOD
  401 IP(I)=IA(I)
   52 READ(7'ILINE,151)(ITITLE(I),I=1,19), N
  151 FORMAT(19A4,I4)
      WRITE(6,403)(ITITLE(I), I=1,19),N
  403 FORMAT('0DATA USED HAS TITLE'/' ',15A4/' ',4A4,6X,'WITH ',I5,
     1' SINGLE DIGIT CODES')
      IF(N-0)159,159,53
```

```
      53  NN=N/IFIEL
      54  M=NN*IFIEL
      55  IF(M-N)153,152,153
     152 CONTINUE
     363 WRITE(6,364)(IA(I),I=1,NECOD)
     364 FORMAT('0CATEGORIES TO WHICH THE  CODES  ARE  PLACED  FOR THIS PAR
         1T OF THE DATA'/' ',(IC14))
     202 IF(ICOLAP-0)201,158,56
     201 DO203 I=1,1000
     203 IPA(I)=NECOD
     204 IF(ICOLAP-(-1))157,205,56
      56  IF(ICOLAP-1) 158, 157, 159
     157 WRITE(6,405)
     405 FORMAT('0TYPE THE SPECIFICATION OF THE COLLAPSING '/'
         1SCHEME BY USING PAIRS OF 4 DIGIT CODES WHERE THE '/'
         2SECOND CODE IS TO BE REPLACED BY THE FIRST CODE '/'
         3(E.G. 00010003 0C010012) SKIP A SPACE BETWEEN EACH SET'/'
         4OF 2 CODES.  DO NOT TYPE MORE THAN 4 PAIRS OF CODES'/'
         5ON ONE LINE')
          READ(5,406)(IR(I),I=1,NCOL)
     406 FORMAT(4(2I4,1X))
     167 WRITE(6,160)
     160 FORMAT('0PAIRS OF CATEGORIES, WHERE THE SECOND CODE OF THE PAIR IS
         1 PLACED INTO THE'/'  CATEGORY REPRESENTED BY THE FIRST CODE')
          WRITE(6,501)(IR(I),I=1,NCOL)
     501 FORMAT(' ',2I5,1X,2I5,1X,2I5,1X,2I5)
          IF(ICOLAP-0)205,158,153
     158 NO=NECOD+2
          DO 21 I=1,1000
      21  IPA(I)=NO
     205 CONTINUE
          DO 22 I=1,NECOD
          K=IA(I)+1
      22  IPA(K)=I
      57  IF(ICOLAP-1) 162,161,159
     161 NNCOL= NCOL*2
          DO 25 I=1, NCOL, 2
          K=IR(I+1)+1
          KK=IR(I)+1
      25  IPA(K)=IPA(KK)
     162 READ(7'ILINE,FOR)(IS(I),I=1,NN)
          ILINE=ILINE+1
     362 CONTINUE
          DO 163 I=1,NN
          K=IS(I)+1
     163 IS(I)=IPA(K)
          ISTRIN=0
          WRITE(6,505)
     505 FORMAT('0IF AT THIS POINT YOU WISH TO HAVE THE SEQUENCE OF TALLIES
         1'/' PRINTED OUT WITH REINTERPRETATIONS (IF ANY WERE SPECIFIED),
         2TYPE'/' 1. OTHERWISE TYPE 0')
          READ(5,507)ISTRIN
```

```
  507 FORMAT(I1)
      IF(ISTRIN-1)58,504,58
  504 DO 508 I=1,NN
      K=IS(I)
  508 JS(I)=IA(K)
      WRITE(6,503)(ITITLE(I),I=1,19),NN
  503 FORMAT('1',15A4/' ',4A4,'; TOTAL NUMBER OF TALLIES IS',I5)
      WRITE(6,506)(JS(I),I=1,NN)
  506 FORMAT(' ',15I4)
   58 MM=NN-1
      DO 164 I=1,MM
      K=IS(I)
      KK=IS(I+1)
  164 IM(K,KK)=IM(K,KK)+1
   52 K=NECOD+1
      DO 65 I=1,NECOD
      DO 65 J=1,NECOD
      IM(I,K)=IM(I,K)+IM(I,J)
   65 IM(K,J)=IM(K,J)+IM(I,J)
      DO 62 I=1,NECOD
   62 IM(K,K)=IM(K,K)+IM(I,K)
      GO TO 159
  153 WRITE(6,154) IFIEL,N
  154 FORMAT('0IFIEL (',I4,') IS NOT DIVISIBLE INTO THE NUMBER OF CODES
     1IN THE CHOSEN DATA SET (N=',I5,').')
      IFIEL=0
  159 CONTINUE
      RETURN
      END
      SUBROUTINE RELF(IM,NECOD,RFIM)
      DIMENSION IM(27,27),RFIM(27,27)
      N=NECOD+1
      GRTOT=IM(N,N)
      DO 64 I=1,N
      DO 64 J=1,N
   64 RFIM(I,J)=(IM(I,J)/GRTOT)*100.
      RETURN
      END
      SUBROUTINE PRINTI(IM,NECOD,IA,ITITLE)
      DIMENSION IM(27,27),IA(30),ITITLE(20)
      WRITE(6,78)(ITITLE(I),I=1,19)
   78 FORMAT('1',19A4/' FREQUENCY MATRIX')
      WRITE(6,      74)(IA(I),I=1,NECOD)
   74 FORMAT('0CAT ',24(2X,I3),' TOTAL')
      N=NECOD+1
      DO 75 I=1,NECOD
   75 WRITE(6,      76)IA(I),(IM(I,J),J=1,N)
   76 FORMAT(' ',I3,1X,25I5)
  212 WRITE(6,79)(IM(N,J),J=1,N)
   79 FORMAT(' TOT ',25I5)
      RETURN
      END
```

```
      SUBROUTINE PRINTF(REIM,NECOD,IA,ITITLE)
      DIMENSION IA(30),ITITLE(20),REIM(27,27)
   76 WRITE(6,77)(ITITLE(I),I=1,19)
   77 FORMAT('1',19A4/' RELATIVE FREQUENCY MATRIX')
     ,WRITE(6,      71)(IA(I),I=1,NECOD)
   71 FORMAT('0CAT',25I5)
      N=NECOD+1
      DO 72 I=1,NECOD
   72 WRITE(6,      73)IA(I),(REIM(I,J),J=1,N)
   73 FORMAT(' ',I3,1X,25F5.1)
   75 WRITE(6,74)(REIM(N,J), J=1,N)
   74 FORMAT(' TOT',1X,25F5.1)
      RETURN
      END
      SUBROUTINE SAMPH(PLL)
C     THIS SUBROUTINE, EXCEPT FOR FEW LINES, HAS BEEN DONATED BY TOMAS S
C     AMPH
      DIMENSION PLL(27,27),L(72),
     1PLRT(27),PLCT(27),X(50),ID(50),
     2Y(50)
      DO 802 I=1,45
      Y(I)=-96
  802 ID(I)=0
      WRITE(6,800)
  800 FORMAT('1TYPE THE VARIABLE SPECIFICATIONS USING UP TO 20'/'
     1ID NUMBERS FROM THE VARIABLE DICTIONARY.  SKIP A SPACE '/'
     2BETWEEN EACH VARIABLE SPECIFICATION (E.G. 01 04 05)')
      READ(5,807)(ID(I),I=1,20)
  807 FORMAT(20(I2,1X))
      DO 9 I=1,10
      PLCT(I)=PLL(I,11)
    9 PLRT(I)=PLL(11,I)
  501 ST=PLCT(8)+PLCT(9)
      NVAR=1
      X(NVAR)=ST
      TT=0
      DO 507 I=1,7
  507 TT=TT+PLCT(I)
      NVAR=2
      X(NVAR)=TT
  509 TT13=0.
      TT67=0.
      DO 511 J=1,3
  511 TT13=TT13+PLCT(J)
  514 TT67=PLCT(6)+PLCT(7)
      IF(TT67-0.)516,101,516
  101 TT67=1.
  516 RID=TT13/TT67
  517 NVAR=3
      X(NVAR)=RID
      TT14=0.
  524 TT14=TT13+PLCT(4)
```

```
      526 TT57=0.
          DO 528 J=5,7
      528 TT57=TT57+PLCT(J)
          IF(TT57-0.)529,102,529
      102 TT57=1.
      529 BID=TT14/TT57
      530 NVAR=4
          X(NVAR)=BID
          TT867=0.
      539 TT813=0.
          DO 541 J=1,3
      541 TT813=TT813+PLL(8,J)
      544 TT867=PLL(8,6)+PLL(8,7)
          IF(TT867-0.)545,103,545
      103 TT867=1.
      545 BID8=TT813/TT867
      546 NVAR=5
          X(NVAR)=BID8
          TT814=0.
      554 TT814=TT813+PLL(8,4)
      556 TT857=0.
          DO 558 J=5,7
      558 TT857=TT857+PLL(8,J)
          IF(TT857-0.)559,104,559
      104 TT857=1.
      559 BID8=TT814/TT857
      560 NVAR=6
          X(NVAR)=BID8
          TT967=0.
      569 TT913=0.
          DO 571 J=1,3
      571 TT913=TT913+PLL(9,J)
      574 TT967=PLL(9,6)+PLL(9,7)
          IF(TT967-0.)575,105,575
      105 TT967=1.
      575 BID9=TT913/TT967
      576 NVAR=7
          X(NVAR)=BID9
          TT914=0.
          TT957=0.
      583 TT914=TT913+PLL(9,4)
      585 TT957=PLL(9,5)+PLL(9,6)+PLL(9,7)
          IF(TT957-0.)586,106,586
      106 TT957=1.
      586 BID9=TT914/TT957
      587 NVAR=8
          X(NVAR)=BID9
          IF(TT867+TT967-0.)588,107,588
      107 TT867=.5
          TT967=.5
      588 BID89=(TT813+TT913)/(TT867+TT967)
      589 NVAR=9
          X(NVAR)=BID89
```

```
      IF(TT857+TT957-0.)590,108,590
  108 TT857=.5
      TT957=.5
  590 BID89=(TT814+TT914)/(TT857+TT957)
  591 NVAR=10
      X(NVAR)=BID89
  611 XIN=0.
      XINTT=0.
      DO614 I=1,3
      DO614 J=1,3
  614 XIN=XIN+PLL(I,J)
      XINTT=XIN/TT*100.
      NVAR=11
      X(NVAR)=XIN
      Y(NVAR)=XINTT
      XDITT=0.
      XINDI=0.
  617 XDI=0.
      DO 621 I=6,7
      DO 621 J=6,7
  621 XDI=XDI+PLL(I,J)
      XDITT=XDI/TT*100.
      NVAR=12
      X(NVAR)=XDI
      Y(NVAR)=XDITT
      IF(XDI-0.)622,109,622
  109 XDI=1.
  622 XINDI=XIN/XDI
  623 IF(XDITT-0.)624,110,624
  110 XDITT=1.
  624 XIDTT=XINTT/XDITT
  625 NVAR=13
      X(NVAR)=XINDI
      Y(NVAR)=XIDTT
      CRUXTT=0.
  631 CRUX=0.
      DO633 I=4,5
      DO633 J=4,5
  633 CRUX=CRUX+PLL(I,J)
      CRUXTT=CRUX/TT*100.
      NVAR=14
      X(NVAR)=CRUX
      Y(NVAR)=CRUXTT
      CROSS=0.
      CROSTT=0.
  637 CROSS=PLCT(4)+PLCT(5)+PLRT(4)+PLRT(5)-CRUX
      CROSTT=(CROSS-PLL(5,8)-PLL(5,9)-PLL(4,8)-PLL(4,9)-PLL(5,10)-PLL(4,
     110))/TT*100.
      NVAR=15
      X(NVAR)=CROSS
      Y(NVAR)=CROSTT
      ZRIDS=0.
      IF(RID8-0.)725,111,725
```

```
  111 RID8=1.
  725 ZRIDS=RID9/RID8
  726 NVAR=16
      X(NVAR)=ZRIDS
      ZBIDS=0.
      IF(BID8-0.)737,112,737
  112 BID8=1.
  737 ZBIDS=BID9/BID8
  739 NVAR = 117
      X(NVAR) = ZBIDS
      CRL67=0.
  744 CRL67=XDI+PLL(6,10)+PLL(7,10)
      NVAR=18
      X(NVAR)=CRL67
  746 SS17=0.
      DO 748 I=1,7
  748 SS17=SS17+PLL(I,J)
      NVAR=19
      X(NVAR)=SS17
      EXTST=0.
  751 EXTST=PLL(8,8)+PLL(9,9)+PLL(8,9)+PLL(9,8)
      NVAR=20
      X(NVAR)=EXTST
      COL1=0.
      COL1TT=0.
  756 COL1=PLCT(1)
      COL1TT=COL1/TT*100.
      NVAR=21
      X(NVAR)=COL1
      Y(NVAR)=COL1TT
      COL2=0.
      COL2TT=0.
      COL2=PLCT(2)
      COL2TT=COL2/TT*100.
      NVAR=22
      X(NVAR)=COL2
      Y(NVAR)=COL2TT
      COL3=0.
      COL3TT=0.
      COL3=PLCT(3)
      COL3TT=COL3/TT*100.
      NVAR=23
      X(NVAR)=COL3
      Y(NVAR)=COL3TT
      COL4=0.
      COL4TT=0.
      COL4=PLCT(4)
      COL4TT=COL4/TT*100.
      NVAR=24
      X(NVAR)=COL4
      Y(NVAR)=COL4TT
      COL5=0.
      COL5TT=0.
```

```
      COL5=PLCT(5)
      COL5TT=COL5/TT*100.
      NVAR=25
      X(NVAR)=COL5
      Y(NVAR)=COL5TT
      COL6=0.
      COL6TT=0.
      COL6=PLCT(6)
      COL6TT=COL6/TT*100.
      NVAR=26
      X(NVAR)=COL6
      Y(NVAR)=COL6TT
      COL7=0.
      COL7TT=0.
      COL7=PLCT(7)
      COL7TT=COL7/TT*100.
      NVAR=27
      X(NVAR)=COL7
      Y(NVAR)=COL7TT
      COL8=0.
      COL8ST=0.
      COL8=PLCT(8)
      COL8ST=COL8/ST*100.
      NVAR=28
      X(NVAR)=COL8
      Y(NVAR)=COL8ST
      COL9=0.
      COL9ST=0.
      COL9=PLCT(9)
      COL9ST=COL9/ST*100.
      NVAR=29
      X(NVAR)=COL9
      Y(NVAR)=COL9ST
      COL10=0.
      COL10=PLCT(10)
      NVAR=30
      X(NVAR)=COL10
      C33=0.
      C33TT=0.
  777 C33=PLL(3,3)
      C33TT=C33/TT*100.
      NVAR=31
      X(NVAR)=C33
      Y(NVAR)=C33TT
      C59=0.
      C59ST=0.
      C59=PLL(5,9)
      C59ST=C59/ST*100.
      NVAR=32
      X(NVAR)=C59
      Y(NVAR)=C59ST
      C22=0.
```

```
      C22TT=0.
      C22=PLL(2,2)
      C22TT=C22/TT*100.
      NVAR=33
      X(NVAR)=C22
      Y(NVAR)=C22TT
      EX33=0.
      IF(PLRT(3)-0.)778,113,778
  113 EX33=99999.
      GO TO 779
  778 EX33=C33/PLRT(3)*100.
  779 NVAR=34
      X(NVAR)=EX33
      EX33F=0.
      IF(PLRT(8)+PLRT(9)-0.)780,114,780
  114 EX33F=99999.
      GO TO 781
  780 EX33F=C33/(PLRT(8)+PLRT(9))*100.
  781 NVAR=35
      X(NVAR)=EX33F
      AMT7=0.
      AMT7TT=0.
      AMT7=COL7-PLL(7,7)
      AMT7TT=AMT7/TT*100.
      NVAR=36
      X(NVAR)=AMT7
      Y(NVAR)=AMT7TT
      AMS9=0.
      AMS9ST=0.
      AMS9=COL9-PLL(9,9)
      AMS9ST=AMS9/ST*100.
      NVAR=37
      X(NVAR)=AMS9
      Y(NVAR)=AMS9ST
      AMT10=0.
      AMT10=COL10-PLL(10,10)
      NVAR=38
      X(NVAR)=AMT10
      AMT2=0.
      AMT2TT=0.
      AMT2=COL2-C22
      AMT2TT=AMT2/TT*100.
      NVAR=39
      X(NVAR)=AMT2
      Y(NVAR)=AMT2TT
      C410=0.
      C410=PLL(4,10)
      NVAR=40
      X(NVAR)=C410
      C55=0.
      C55TT=0.
      C55=PLL(5,5)
      C55TT=C55/TT*100.
```

```
      NVAR=41
      X(NVAR)=C55
      Y(NVAR)=C55TT
      C99=0.
      C99ST=0.
      C99=PLL(9,9)
      C99ST=C99/ST*100.
      NVAR=42
      X(NVAR)=C99
      Y(NVAR)=C99ST
      AMT4=0.
      AMT4TT=0.
      AMT4=COL4-PLL(4,4)
      AMT4TT=AMT4/TT*100.
      NVAR=43
      X(NVAR)=AMT4
      Y(NVAR)=AMT4TT
      FLEXM=0.
      FLEXM=((6*PLL(5,3))+(PLL(5,4))+(3*PLL(3,5))+(3*PLL(3,4))+PLL(8,3)
     1+(PLL(9,5)*(-.5))+PLL(9,4))/((PLL(3,3)*.5)+PLL(4,4)+PLL(5,5)+
     2PLL(5,4)+(4*PLL(8,4))+(4*PLL(8,5)))
      NVAR=44
      X(NVAR)=FLEXM
      AMT6=0.
      AMT6TT=0.
      AMT6=COL6-PLL(6,6)
      AMT6TT=AMT6/TT*100.
      NVAR=45
      X(NVAR)=AMT6
      Y(NVAR)=AMT6TT
      DO 801 I=1,45
      IF(ID(I)-0)803,803,804
  804 IF(Y(ID(I))+96) 805, 806, 805
  806 WRITE(6,980)ID(I),X(ID(I))
      GO TO 801
  805 WRITE(6,980)ID(I),X(ID(I)),Y(ID(I))
  801 CONTINUE
  980 FORMAT(2X,I4,2X,F10.3,5X,F10.3)
  803 RETURN
      END
```

Specifications to Use the Interaction Analysis Matrix Program on a Terminal. When using this computer program, the user should specify the devices in his situation to which the device numbers in the program refer. Device 7 in the program must be defined as the direct access file in which the cleaned-up data have been stored by the data clean-up program described earlier. Device 5 must be defined as some sequential input

device (e.g., terminal). Device number 6 must be defined as a sequential output device (e.g., printer at a terminal).

When the terminal is being used to process the data collected in the manner described earlier, all requests to the user will be printed by the terminal at various points in time. The user will be requested to provide values for some variables. What the program will do will depend on the values the user provides. The values the user should provide for the various variables under given conditions are described below. The format the user should use in specifying these values is described in the request on the terminal output. Unless otherwise stated, the printing of instructions should begin in the first column. The nature of most of the instructions which are printed by the terminal are listed in Appendix C. It might be helpful to the user to familiarize himself with these instructions in Appendix C.

Description of the Options for the Various Variables Used in the Specification Statements.

IL		The line number of the cleaned-up data with which the data analysis is to begin, e.g., 0002, 0567. A -1 will terminate the job.
IFIEL		The number of columns from the beginning of one code that is to be read up to the beginning of (but not including) the next code, e.g., 1, 3.
JCONT	0	No more specification statements will follow this set.
	1	At least one more set of specification statements will follow this set.
IMATRI	0	No frequency matrix is requested.
	1	A frequency matrix is requested.
IRELF	0	No relative frequency matrix is requested.
	1	A relative frequency matrix is requested.
	2	Flanders' ten categories are used and some variables defined by Samph are requested.

FORMAT — Any format which is consistent with the integer used for IFIEL and is consistent with the data which are to be analyzed. The codes are to be read as integers (I-fields) and columns to be skipped should be designated as X (e.g., 2X = skip 2 columns).

The format has to account for the first 66 columns on each data record. Below are examples of formats.

Format	Explanation
(66I1)	66 one-digit codes are to be read on each record. IFIEL in this case is 1.
(33I2)	33 two digit codes are read on each record. IFIEL in this case is 2.
(22I3)	22 three digit codes are read on each record. IFIEL in this case is 3.
(33(I1, 1X))	Each record contains 33 two digit codes; however, the user is not interested in the second digit of each code and, therefore, is specifying that only the first digit of each code to be read. This may be thought of as a certain kind of collapsing scheme. IFIEL, in this case, is 2.
(22(1X,I2))	The record contains 22 three digit codes; the user is interested in using only the last two digits of each code to describe that three digit code. IFIEL, in this case, is 3.

Note that the format has to be enclosed in parentheses.

NOCOD — Number of codes that will be used in the output, e.g., 09, 22.

ICOLAP

00 There will be no more specifications for collapsing of some categories.

01 There will be specifications for collapsing of some categories upon some other categories.

-1 All codes not mentioned in IA, as defined below, should be replaced by the last code in IA (e.g., if IA = 1, 2, 3, 4, 5, 0, then codes such as 6 and 8 should be placed into category 0).

NCOL

0 0 or -1 has been used for ICOLAP.

If ICOLAP has been set equal to 1, NCOL should be set equal to two times the number of codes that will be reinterpreted. This is the same as the number of codes used to define IR below.

IA — List of codes which will be used in the output. These codes should appear on the interaction analysis data records or in IR as categories into which the tallies of some other category are placed.

IR — A sequence of pairs of digits defining categories. Tallies in the second category of the pair will be added to the tallies in the first category of the pair. If ICOLAP is 0, then this sequence of digits is left out.

ISTRIN — If a 1 is printed in the first column, the tallies (with reinterpretation) will be printed in a sequential format (See Figure 8). If 0 is printed in the first column, this output will be deleted.

ID — If IRELF is set equal to a 2, then ID contains the sequence of identification numbers for the variables the user wishes to have printed out. (One should refer to the dictionary of variables in Appendix B.)

CHAPTER 3

EXAMPLES OF THE USE OF THE DATA COLLECTION AND THE FEEDBACK SYSTEM

Examples of Category Systems Used

Most of the following coding systems have been tried in live classroom[a] conditions. The data were recorded through the use of a touch telephone keyboard. The teachers who gave permission to use their classrooms to test the data collection system were part of an inservice training program developed and conducted by MOREL.

There are ten digits which may be used to code verbal interaction on the touch telephone devices employed in this project. This enables the observer to use coding schemes that have up to ten categories. For each piece of behavior, the observer decides upon the correct or most appropriate category and then presses the key corresponding to the numeral code of that category. This process is repeated at prescribed time intervals. It is relatively easy to repeat the process every three seconds when using only one digit codes involving up to ten categories. In fact, using a four digit category scheme with a three second interval is well within the realm of an observer's capability when using touch telephone devices to record the information.

A Two Digit Coding System Based on Flanders' 10 Categories.

Flanders' basic ten categories (see Appendix A) can be broken down into Subcategories so that 22 categories can be identified (see Appendix D).

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[a]The checking in live situations of the category systems described in this section have been done by George Miller.

This scheme can be represented as a two digit code. When the touch telephone device is used, the main category is pressed first, followed by the appropriate subscript. Only ten digits appear on the touch telephone unit; therefore, the number of digits available for use as codes is limited to nine, since, when using two or more digits for a code, one numeral must be used as a separation code.

One may elect to eliminate category one (acceptance of feeling), since it is rarely used, and, in its place substitute category ten (silence or confusion). Zero in this case may be used as a separator of the two-digit codes. The zero is an ideal separator of codes because it is located in the bottom row of the keyboard, and no other numeral appears in that row. Category seven in this scheme has no sub-categories; therefore, 9 may be used as the second digit of the code whenever category seven is recorded. Every three seconds the observer presses the key representing the main category, then he presses the key representing the appropriate sub-category, and finally the key representing the separator code (zero) being used to separate the two-digit category codes. No difficulty has been encountered in using the touch telephone device to record this two-digit category scheme accurately and reliably.

A Three-Digit Coding System Studying Student Participation

The use of a three-digit category scheme enables the observer to quantify much more information about the interaction between a teacher and his students and enables the researcher or the teacher to learn much more about the interaction with regard to individual students. The category scheme described here requires the visual as well as the auditory attention of the observer.

Zero is used to separate the three-digit codes. With the exception of category one (which was omitted), Flanders' basic ten categories are used

and the first digit of each code is used to represent one of these nine categories. Category ten (silence or confusion) is recorded as a one whenever it occurs.

The second digit of the three-digit code represents the column in which a particular student is sitting and the third digit represents the row in which that student is sitting. Thus, whenever the interaction involves a particular student, the last two digits of the three-digit code are used to denote the particular student to whom the teacher is talking (or referring) or to the student who is talking. When the teacher is talking to the class as a whole, the first digit indicates the appropriate category, and the last two digits are recorded as nines. The following additional information becomes available when such a three digit categorization scheme is utilized:

1. The percentage of time the teacher spent talking to the class as a whole
2. The percentage of the time the teacher spent talking (or referring) to each student in the class
3. The number of times the teacher interacted with each student
4. The nature of each interaction with each student

This information would enable the teacher or consultant to find answers to many interesting questions, including the following: What specific types of verbal teacher behavior will encourage particular students to participate in the teaching-learning process? Which students are not being encouraged to participate and what is the effect of this on given educational outcome variables? What is the effect of increasing the percentage of time the teacher spends interacting with individuals as opposed to percentage of time spent interacting with the class as a whole? What is the effect of increasing the number of students with whom the teacher interacts within a given period of time? What happens (in terms of educational outcome variables) when the

teacher increases the number of interactions with low-achieving students? How are high-achieving students affected by a reduction in the number of interactions with the teacher?

This type of category scheme becomes practical when a device such as a touch telephone unit is available for use by the observer. The scheme requires the observer to constantly be aware of who is doing the talking and to whom the talking is directed. It is extremely difficult to code reliably using such a three-digit system if the observer must take his eyes away from the class to see what he is recording.

However, once an observer acquires skill with the touch telephone unit, he need never glance or look at the keyboard of the unit to see which numbers he is pressing. His attention is always on the source of action. Although glancing down at the paper every three seconds is not such a crucial threat to reliability when a simpler coding scheme is being used, it does appear logical that continuous attention to the behavior which is being coded will enable the observer to be more accurate and thus more reliable in his coding, regardless of the complexity of the coding scheme being used. An advantage of the touch telephone device over paper-pencil techniques of collecting data is that it gives the observer the opportunity to use more complicated category schemes and schemes which employ visual as well as verbal cues.

The Reinforcement Versus Student Participation Schedule

Several category schemes have been tried on the touch telephone data set which were less complicated in terms of the number of categories than the scheme described above, but which would enable the teacher or consultant to assess specific problems. One such system which has been tested at Jefferson Junior High School in Pontiac, using the touch telephone units, involved only six categories but used three digits. It is called "THE REINFORCEMENT VS.

STUDENT PARTICIPATION SCHEDULE." The first digit indicates which of the six categories the interaction of the preceding three seconds falls under, while the second two digits indicate the column and row (i.e., the particular student) to whom the teacher is talking or to whom the teacher is listening. The categories are as follows:

1. Teacher talk to a particular student which reinforces student participation
2. Teacher talk to a particular student which does not reinforce student participation
3. Other teacher talk and/or nonconstructive student talk, or silence
4. Student response
5. Student initiation addressed to the teacher
6. Student initiation addressed to the class

The purpose of this category system is to provide teachers with objective information about their effectiveness in controlling the behavior of particular students. Since each individual has a unique personality, it cannot be assumed that every student will react in the same manner to a given statement from the teacher. Category schemes of this type will permit teachers to learn more about the way in which individual students perceive what the teacher says so that he can learn more effective methods of communicating and controlling student behavior and evaluate their effectiveness. If individualization of instruction is to take place, it is imperative that teachers know more about the effects of their behavior on individual students.

A Work Session Record of Eight Students

One of the objectives of education is to instill in students work habits which are effective, both when working alone and when working in groups. Although work sessions often take place in the classroom, it is often difficult to assess objectively how diligently certain students are working

and to decide what can be done to improve the work session. It may be that some students have a disturbing influence on others, that certain students need the help of others, or that the physical arrangement of the classroom is not conducive to work sessions. Perhaps merely rearranging or removing a few seductive props (both animate and inanimate) will facilitate the achievement of the goals set for the work session.

An observer, sitting in the rear of a classroom, can gather an extensive amount of reliable information about the behavior of up to eight students during a work session, if he doesn't have to take his eyes off the action. Following is an example of a category scheme which could be developed to assess student to student interaction. The system involves the use of a three-digit code to record the actions of the students being observed. It is extremely difficult to use this system when it is necessary to write down the three-digit codes every three seconds because the observer must glance at the paper each time he records a code. The touch telephone device enables the observer to constantly focus his attention on what he is observing, and it shortens the time required to record the data. This system of recording also permits the observer to be less conspicuous in the sense that he need not look directly at certain students in order to be aware of what is taking place.

The first digit indicates the category into which the behavior falls. It can include non-verbal behavior (action) as well as verbal behavior. The second digit of the code indicates the person whose behavior (including verbal) is being recorded. The third digit indicates the person to whom the action or verbal behavior was directed. The observer assigns each of the students a number which the observer maintains in his memory throughout the observation period.

CATEGORIES:

1. All students working diligently
2. Student talking with the teacher
3. Student talking constructively with another student
4. Student talking nonconstructively with another student
5. Student visually communicating with another student in a nonconstructive manner

EXAMPLES:

1,9,9 indicates all students are working diligently.

2,7,9 indicates student #7 is talking with the teacher (who is given the code #9).

2,9,7 indicates the teacher is talking with student #7.

3,4,5 indicates student #4 is talking constructively with student #5.

3,4,9 indicates student #4 is talking constructively with a student outside the group being directly observed.

4,5,4 indicates student #5 is talking in a nonconstructive manner with student #4.

4,9,5 indicates a student not included in the group being observed is talking in a nonconstructive manner with student #5.

5,1,4 indicates that student #1 is non-verbally communicating with student #3 in a nonconstructive manner.

Depending on the nature of what the teacher wished to determine and the nature of the work session, it may not be necessary or possible to include eight students in the recorded observation. If a number of students are interacting at the same time, the observer will have to decide which interactions are most significant and record them. When analyzing the data with the teacher, the observer should point out that (in this case) there were interactions which took place that he was unable to code. Since this type of system is designed explicitly for assisting the teacher, and not necessarily

for highly reliable data collection, these problems should be resolved by the observer and the teacher in a manner dictated by the needs of the teacher and the nature of the situation. Usually, those students in the group being observed who are not recorded as participating in an interaction are assumed to be working diligently during that three-second period.

An observer, with a little practice, could use the category system described above as part of a 4- or 5-digit category system. Instead of coding every three seconds, the observer could code interaction as units. The fourth and fifth digits would indicate the length of time the interaction lasted. In this way, the observer could keep track of and record two interactions taking place simultaneously. The number of times a particular behavior took place, plus the length of time it lasted, will be easier to code in this type of system than will attempting to code every three seconds. What is lost is the exact sequence of events. While this may be important for some types of information, the teacher still gains considerable insight by learning who talked to whom for how long and by learning the nature of that interaction.

Examples of Uses of the Computer Programs to Answer Questions About the Behaviors in a Classroom

Use of Student Ideas

In a given situation, suppose a teacher is interested in learning whether or not he uses student ideas immediately after a student has made a statement. To deal with this problem, one needs to pay attention only to categories 31, 32, 33, 34, 81, 82, 91, and 92 in the 22-category scheme described in Appendix D. Therefore, all other categories may be replaced with a 0. The resulting sequence as produced by the Interaction Analysis Matrix Program on a terminal printout is shown in Figure 13.

A more condensed description of these data is contained in the Flanders' type frequency matrix in Figure 14 produced by the interaction analysis matrix program.

Using this output, the teacher or a consultant may very quickly identify sections in the teacher-pupil interaction which he wishes to study further. He can then locate the corresponding sections on a video tape or audio tape (if such is available), assess what he did, and discuss what might have been done differently. This avoids the problem of playing the tapes over several times to identify behaviors which are of interest to the teacher or the consultant.

```
22222222222222222222
        001     ; TOTAL NUMBER OF TALLIESIS  365
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0 92 92 91 91 92
92 92 92 92 92 92 92 92 91 91 91  0  0  0  0  0  0 81 81  0
 0 91 91  0  0 92 92  0  0  0  0  0  0 92 92 92 92 92 92 92
92 91  0  0  0  0  0 82 82  0  0  0 92 92 92 92 92 92 92 92
 0  0  0  0  0 92 92 92 92 92  0  0 81 81 32 32  0  0  0  0
81 81 82 91 91 32 32 34 34 34  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0 82 82 82  0  0  0  0  0 91 91 91  0  0 91 91
91 91  0  0 34 34 32 81 81 81  0  0  0  0  0  0  0  0  0  0
91 92 92  0  0  0  0  0  0  0  0  0  0  0  0  0 92 92 92 92
 0  0  0  0  0 92 92  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0 82 82 82 31 82 82 82 32 32 32 34 34 34 34  0
 0  0  0  0  0  0  0  0  0  0 91 91 91  0 31  0  0  0  0  0
 0  0  0 81 81 81 81 33 33 33  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0 92 92 92 92 92
92 92 92  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0 81  0 81  0 81  0 81 81  0 81  0  0 81 81 82  0  0 34
34 34  0  0  0  0  0  0  0  0  0  0  0 92 92 91 91 91 91 91
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 0  0  0  0  0
```

Figure 13 - A Sequential Display of Tallies

```
22222222222222222222
FREQUENCY MATRIX

CAT      31   32   33   34   81   82   91   92    0
 31       0    0    0    0    0    1    0    0    1     2
 32       0    4    0    2    1    0    0    0    1     8
 33       0    0    2    0    0    0    0    0    1     3
 34       0    1    0    8    0    0    0    0    3    12
 81       0    1    1    0   10    2    0    0    7    21
 82       1    1    0    0    0    7    1    0    3    13
 91       0    1    0    0    0    0   16    2    7    26
 92       0    0    0    0    0    0    4   41    7    52
  0       1    0    0    2   10    3    5    9  197   227
TOT       2    8    3   12   21   13   26   52  227   364
```

Figure 14 - A Frequency Matrix Pertaining to Teacher's Use of Students' Ideas

Student Involvement

Suppose a teacher is interested in looking at the extent to which he attempts to involve each student in a class discussion, and suppose that the data described earlier in this chapter in the section -- "A Three-digit Coding System Studying Student Participation" -- has been collected for such a situation. Assume that the teacher is particularly interested in students with identification codes 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44 and 45. If he is also interested in looking at his change of attention from a student to the whole class, category 99 may also be included. Since, at the moment, other students are not of interest, their identification codes may be placed in category 0. The frequency matrix of the paired codes in Figures 15 and 16 provides the information pertaining to student involvement.

At this point the teacher or the consultant might be interested in looking in greater detail at the interaction between one of the most talkative students and himself. By looking at the matrices in Figures 15 and 16 one can identify student 31 as a student who talks to or is addressed by the teacher a great deal. Now, to look more closely at the interaction between this student and the teacher, one may look at categories 231, 331, 431, 631, 731, 831, and 931. The remaining interaction may be placed in some other category, such as category 0. The resulting frequency matrix is in Figure 17.

The matrix in Figure 18 can be used to study the interaction among the students most involved in the discussion as judged from the matrices in Figures 15 and 16.

The frequency matrix in Figure 19 has been derived from the same data as the displays in Figures 13-18; however, in this case, the part of the codes identifying the speaker or the person to whom the statement is being made is

ignored. Figure 20 contains the relative frequency matrix of the frequency matrix in Figure 19.

3333333333333333333
FREQUENCY MATRIX

CAT	11	12	13	14	15	21	22	23	24	25	0	
11	10	0	0	0	0	1	1	0	0	0	6	18
12	0	7	4	0	0	0	0	0	0	0	4	15
13	0	2	14	0	0	0	0	0	0	0	6	22
14	0	1	0	3	0	0	0	0	0	0	3	7
15	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	5	0	0	0	0	1	6
22	1	1	0	0	0	0	2	0	0	0	0	4
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
0	7	4	5	4	0	0	1	0	0	0	213	234
TOT	18	15	23	7	0	6	4	0	0	0	233	306

Figure 15 - A Frequency Matrix Pertaining to Students' Involvement in a Discussion

3333333333333333333 00
FREQUENCY MATRIX

CAT	31	32	33	34	35	41	42	43	44	45	99	0	
31	19	0	1	0	0	0	0	0	0	0	4	9	33
32	1	0	0	0	0	0	0	0	1	0	0	0	2
33	1	1	2	0	0	0	0	0	0	0	0	2	6
34	0	0	0	0	0	0	0	0	0	0	1	0	1
35	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	3	0	0	0	0	0	1	4
42	1	0	0	0	0	0	0	0	0	0	1	0	2
43	1	0	0	0	0	0	0	0	0	0	1	0	2
44	1	0	0	0	0	0	0	0	1	1	0	0	3
45	0	0	1	0	0	0	0	0	0	3	0	1	5
99	3	0	1	1	0	1	0	1	1	0	70	18	96
0	6	1	1	0	0	0	2	1	0	1	19	121	152
TOT	33	2	6	1	0	4	2	2	3	5	96	152	305

Figure 16 - A Frequency Matrix Pertaining to Students' Involvement in a Discussion

3333333333333333333
FREQUENCY MATRIX

CAT	231	331	431	631	731	831	931	0	
231	0	0	0	0	0	0	0	1	1
331	0	0	0	0	0	0	0	1	1
431	0	0	2	0	0	3	0	2	7
631	0	0	0	0	0	0	0	0	0
731	0	0	0	0	0	0	0	0	0
831	1	0	0	0	0	5	0	5	11
931	0	1	1	0	0	0	5	5	12
0	0	0	4	0	0	3	7	260	274
TOT	1	1	7	0	0	11	12	274	306

Figure 17 - A Frequency Matrix Pertaining to the Interaction Between the Teacher and Student #31

3333333333333333333
FREQUENCY MATRIX

CAT	11	12	13	31	99	0	
11	10	0	0	0	1	7	18
12	0	7	4	2	1	1	15
13	0	2	14	0	2	4	22
31	2	0	0	19	4	8	33
99	1	0	2	3	70	20	96
0	5	6	3	9	18	81	122
TOT	18	15	23	33	96	121	306

Figure 18 - A Frequency Matrix Describing Interaction Among the Most Involved Pupils

3333333333333333333
FREQUENCY MATRIX

CAT	2	3	4	5	6	7	8	9	0	
2	0	0	6	0	0	0	1	1	0	8
3	0	3	4	2	0	0	1	4	2	16
4	0	1	20	0	0	0	29	6	2	58
5	0	0	6	17	2	1	1	2	0	29
6	0	0	0	0	1	0	1	3	0	5
7	0	0	0	2	0	1	1	1	1	6
8	6	7	14	2	0	2	32	11	1	75
9	2	6	6	4	2	1	7	34	2	64
0	0	0	2	1	0	1	2	2	37	45
TOT	8	17	58	28	5	6	75	64	45	306

Figure 19 - A Frequency Matrix Based on the First Digit of Three Digit Codes

33333333333333333333
RELATIVE FREQUENCY MATRIX

CAT	2	3	4	5	6	7	8	9	0	
2	0.0	0.0	2.0	0.0	0.0	0.0	0.3	0.3	0.0	2.6
3	0.0	1.0	1.3	0.7	0.0	0.0	0.3	1.3	0.7	5.2
4	0.0	0.3	6.5	0.0	0.0	0.0	9.5	2.0	0.7	19.0
5	0.0	0.0	2.0	5.6	0.7	0.3	0.3	0.7	0.0	9.5
6	0.0	0.0	0.0	0.0	0.3	0.0	0.3	1.0	0.0	1.6
7	0.0	0.0	0.0	0.7	0.0	0.3	0.3	0.3	0.3	2.0
8	2.0	2.3	4.6	0.7	0.0	0.7	10.5	3.6	0.3	24.5
9	0.7	2.0	2.0	1.3	0.7	0.3	2.3	11.1	0.7	20.9
0	0.0	0.0	0.7	0.3	0.0	0.3	0.7	0.7	12.1	14.7
TOT	2.6	5.6	19.0	9.2	1.6	2.0	24.5	20.9	14.7	100.0

Figure 20 - A Relative Frequency Matrix of the Frequency Matrix in Figure 19

Errors Resulting Through the Use of the Touch Telephone Keyboard in Data Transmission

In this project it was not possible to collect much data to check out the changes of reliability in coding from the situation where a paper pencil technique is used to a situation where the touch telephone keyboard is used. In one case three trained observers, but not experienced in the use of a touch telephone keyboard, transmitted 100 tallies from a code sheet. The percent of errors in transmission by the observer were 0%, 2%, and 8%. The same three observers made 0% errors in the second attempt to transmit the 100 codes. The observers who had made errors on the first attempt claimed they slowed down on the second attempt to transmit data.

Summary

Before using any of the program, one should carefully think through what information is of interest to him and how the computer programs could help him get this information. Usually the questions one asks about the data should come before one decides on a data collection procedure. The category

systems and the methods of analysis should be directly related to the information sought.

The use of a touch telephone keyboard facilitates data collection, since one can train himself to record the data without ever looking at the device through which the data is being recorded. This permits the observer to pay more attention to the behaviors under observation. It is also easier to record a code by just touching a key than by writing down the code. The touch telephone data collection system was tried with up to four-digit codes to categorize some behaviors taking place within about a three second interval. In this project the observer used three-digit codes to categorize about 20 different time intervals every minute. It appears that, when slightly longer time intervals are used, little difficulty is encountered in using four-digit codes to categorize these behaviors. The amount of difficulty encountered by the observer will depend on the simplicity of the structure of the category systems used. It probably is easier simultaneously use four category systems, each consisting of four categories, than to use three category systems, consisting of 2, 32, and 4 categories respectively. Note that in both cases a piece of behavior is being placed into one of 256 categories (4x4x4x4 = 2x32x4 = 256).

CHAPTER 4

DISCUSSION AND CONCLUSIONS

Needed Modifications in the Data Processing

Flexibility in the Data Collection

With additional work on the data clean-up program, one could built more flexibility into the data collection procedure. At the present it is possible for the observer to make errors which produce empty data records or half-filled data records in the middle of a data set. The present data clean-up program has not been written to make appropriate corrections in this kind of situation. If the present program encounters such an error, the data processing is terminated. It should not be too difficult to write the program so that, when it identifies this situation as an error, it makes an appropriate correction and continues the data processing.

In the situation in which single-digit codes are used with no separation code, a data set is supposed to be terminated with at least 60 zeroes. In this situation, zero is a permissible code. One may not have more than 59 consecutive zeroes in the middle of the set. This limitation should be removed, since it is too much to ask the observer to be concerned about how many consecutive zeroes he records in the middle of an observation period. Since zeroes are used to indicate the end of a data set where single-digit codes are used, the coder should not use a zero to describe the last time interval that is being categorized. If he does it anyway, that zero will be ignored in the analysis.

Processing of the Cleaned-up Data

The interaction analysis programs used in this project have been written to deal with only a limited number of questions which might be asked about a set of interaction analysis data. In order to decide what additional computer programs would be useful or how the present programs could be modified to make them more useful, a list of questions a teacher or a consultant might ask about interaction analysis data should be compiled. The best source of these questions would be a sample of teachers and consultants who are representative of the individuals who will eventually use these programs. On the basis of such a list of questions, modifications in the present programs can be made, or additional computer programs can be written.

The programs which in the present project process the interaction analysis data from a terminal have been written in such a manner that various kinds of instructions to the user are displayed on the terminal while the data is being processed. These instructions need some polishing. It would be helpful to have the programs rewritten in such a manner that the user is able to request various amounts of instructions, depending on his familiarity with the instructions.

The computer programs in this project have not been written to anticipate errors in specifications. Consequently, if an error is made which is not consistent with the logic of the program, the job is terminated and the user has to start from the beginning of the program. It would be helpful to the user to have the diagnoses printed out in the cases when he makes errors and to have the program written so that he can make corrections without starting from the beginning of the computer program. It would also be helpful to the user to be able to recycle the computer program and to provide only those specifications which are different from the ones used in the previous cycle.

This feature would also make the computer programs more usable for batch processing.

The present interaction analysis matrix program has been written in such a manner that it is not possible to analyze data which have been collected through the use of codes consisting of Y digits where 66 ÷ Y is not an integer. For example four, five and seven digit codes cannot be used. If the programs would be rewritten so that the first 60 columns instead of the first 66 columns of each record in the direct access file are used for storage of the cleaned up data, it would be possible to use one, two, three, four, or five digit codes in the data collection.

Asking Questions About the Data

It is possible that a user of the data processing system might ask the questions about the data in such a manner that there is a direct correspondence between his questions and the format of the information required by the computer programs. The problem posed by this possibility should not be considered too great, since it forces the user to operationalize his questions and focus them on the behaviors which the data under consideration represent.

Comments About the Touch Telephone Data Set

At the present, the touch telephone data set used in the classrooms is somewhat cumbersome for carrying from one location to another one. It would be helpful to construct the data set so that the whole setup could be easily carried with one hand.

The cords on the touch telephone data set should be long enough to allow the observer to station himself any place in the back of a classroom.

In order that the cords not be unreasonably long, the sockets into which these cords have to be plugged should be in the central part of the back of the classroom.

The Data Collection and Processing System Which Has Been Tested

At the present time, it is possible to collect interaction analysis data through the use of a touch telephone data set and have the data, as they are being collected, stored on data cards. From the data cards the data can be transferred to a direct access file in a computer system. The computer programs described in Chapter 2 should be stored within this computer system. From a terminal, which is part of the computer system, an inservice training program staff member can process the data, using the techniques discussed in Chapter 2. It is also possible to process the data through batch-processing techniques.

Conclusions

The feasibility of installing, in a particular school building, the data collection and processing system described in this report depends on the interest of the teachers in that school in looking at their own and the pupils' behaviors in an objective manner, the availability of a computer system which has the capability of receiving data through the use of a touch telephone data set, and the presence of input/output terminals of this computer system in the school building under consideration. In order for the data collection and processing system described in this project to be useful, the user should already be skillful in using various category systems or in developing category systems with various kinds of specifications, and he should be familiar with the input/output terminal available to him. The familiarity with a terminal should

not be difficult to acquire if a well-planned computer system is available to the user.

Before such a data collection and processing system as is described in this project is installed in a school building, it is essential to have a teaching staff that has a need for collecting objective data about human behaviors. The staff should be sufficiently imaginative and willing to think of new situations in which such a data collection and processing system could be used. The staff should be willing to learn enough about the data collection and processing methods to be able to make suggestions as to how the total system could be improved to satisfy their needs. In order to perfect a data collection and processing system, it is essential that the system be used whenever possible while it is being perfected.

The cost of having a computer system available to the staff in a school building can be justified if the computer system is utilized for many purposes. Helping teachers to look at their own behaviors should be just one of the many ways a terminal to a computer system is utilized in a school building. The terminal to a computer system, for example, could be used for bookkeeping, instruction of students, scoring and analyzing of instruments, cataloging of library materials, and keeping of student records.

APPENDICES

APPENDIX A

FLANDERS' TEN CATEGORIES

TEACHER TALK	INDIRECT INFLUENCE	1.* ACCEPTS FEELING: accepts and clarifies the feeling tone of the students in a nonthreatening manner. Feelings may be positive or negative. Predicting or recalling feelings are included. 2.* PRAISES OR ENCOURAGES: praises or encourages student action or behavior. Jokes that release tension, not at the expense of another individual, nodding head or saying, "um hm?" or "go on" are included. 3.* ACCEPTS OR USES IDEAS OF STUDENT: clarifying, building, or developing ideas suggested by a student. As a teacher brings more of his own ideas into play, shift to category five. 4.* ASKS QUESTIONS: asking a question about content or procedure with the intent that a student answer.
	DIRECT INFLUENCE	5.* LECTURING: giving facts or opinions about content or procedure; expressing his own ideas, asking rhetorical questions. 6.* GIVING DIRECTIONS: directions, commands, or orders to which a student is expected to comply. 7.* CRITICIZING OR JUSTIFYING AUTHORITY: statements intended to change student behavior from nonacceptable to acceptable pattern; bawling someone out; stating why the teacher is doing what he is doing; extreme self-reference.
STUDENT TALK		8.* STUDENT TALK--RESPONSE: a student makes a predictable response to teacher. Teacher initiates the contact or solicits student statement and sets limits to what the student says. 9.* STUDENT TALK--INITIATION: talk by students which they initiate. Unpredictable statements in response to teacher. Shift from 8 to 9 as student introduces own ideas.
		10.* SILENCE OR CONFUSION: pauses, short periods of silence and periods of confusion in which communication cannot be understood by the observer.

*There is NO scale implied by these numbers. Each number is classificatory, it designates a particular kind of communication event. To write these numbers down during observation is to enumerate, not to judge a position on a scale.

APPENDIX B

DEFINITIONS OF 46 VARIABLES BASED ON FLANDERS' 10 CATEGORIES

VARIABLE NO. — VARIABLE NAME AND DESCRIPTION

101 = PERCENT STUDENT TALK (COLUMNS 8 AND 9)
102 = PERCENT TEACHER TALK (COLUMNS 1 THROUGH 7)
103 = REVISED INDIRECT-DIRECT RATIO (COLUMNS 1-3 OVER COLUMNS 6 AND 7)
104 = BIG INDIRECT-DIRECT RATIO (COLUMNS 1-4 OVER COLUMNS 5-7)
105 = REVISED INDIRECT-DIRECT ROW 8 (ROW 8, COLUMNS 1-3 OVER ROW 8, COLUMNS 6-7)
106 = BIG INDIRECT-DIRECT RATIO ROW 8 (ROW 8, COLUMNS 1-4 OVER ROW 8, COLUMNS 5-7)
107 = REVISED INDIRECT-DIRECT ROW 9 (ROW 9, COLUMNS 1-3 OVER ROW 9, COLUMNS 6-7)
108 = BIG INDIRECT-DIRECT RATIO ROW 9 (ROW 9, COLUMNS 1-4 OVER ROW 9, COLUMNS 5-7)
109 = REVISED INDIRECT-DIRECT RATIO ROWS 8 AND 9 (ROWS 8 AND 9 COLUMNS 1-3 OVER ROWS 8 AND 9 COLUMNS 6-7)
110 = BIG INDIRECT-DIRECT RATIO ROWS 8 AND 9 (ROWS 8 AND 9 COLUMNS 1-4 OVER ROWS 8 AND 9 COLUMNS 5-7)

THE VARIABLE IN COLUMN ONE INDICATES A CALCULATION BASED ON THE TOTAL TEACHER MATRIX.
THE SECOND COLUMN IS A VALUE FOR THE SAME VARIABLE BUT IS BASED ON ONLY THE TEACHER TALK CATEGORIES.

111 = EXTENDED INDIRECT AREA (COLUMNS 1-3 OF ROWS 1-3)
112 = EXTENDED DIRECT AREA (CELLS (6,7)+(7,7)+(7,6)+(6,6)
113 = EXTENDED INDIRECT-DIRECT RATIO (VARIABLE 111 OVER 112)
114 = THE CRUX OF THE CONTENT CROSS (CELLS (4,5)+(5,5)+(5,4)+(4,4)
115 = CONTENT CROSS (COLUMNS 4-5 AND ROWS 4-5)
116 = RATIO OF VARIABLE 107 OVER 105
117 = RATIO OF VARIABLES 108 OVER 106
118 = VICIOUS CIRCLE - CELLS (6,6)+(6,7)+(7,7)+(7,6)+(6,10)+(7,10)
119 = STUDY-STATE CELLS. SUM OF CELLS ON THE DIAGONAL OF THE MATRIX.
120 = EXTENDED STUDENT TALK (CELL (8,8)+(8,9)+(9,9)+(9,8))

THE FOLLOWING VARIABLES ARE THE COLUMN TOTALS AS DISPLAYED IN THE MATRIX.

121 = COLUMN ONE - ACCEPTING STUDENT FEELINGS
122 = COLUMN TWO - PRAISE
123 = COLUMN THREE - ACCEPTING STUDENT IDEAS
124 = COLUMN FOUR - ASKING QUESTIONS
125 = COLUMN FIVE - LECTURE

126 = COLUMN SIX - GIVING DIRECTIONS
127 = COLUMN SEVEN - CRITICIZING
128 = COLUMN EIGHT - STUDENT TALK RESPONSE
129 = COLUMN NINE - STUDENT TALK INITIATION
130 = COLUMN TEN - SILENCE OR CONFUSION
131 = EXTENDED ACCEPTANCE OF STUDENT IDEAS - THREE-THREE CELL
132 = STUDENT INITIATION AFTER TEACHER LECTURE - FIVE-NINE CELL
133 = EXTENDED TEACHER PRAISE - TWO-TWO CELL
134 = RATIO OF EXTENDED THREES TO THE TOTAL NUMBER OF THREES
135 = RATIO OF EXTENDED THREES TO TOTAL STUDENT TALK
136 = THE NUMBER OF SEVENS - COLUMN SEVEN - SEVEN, SEVEN CELL
137 = THE NUMBER OF NINES, COLUMN NINE - NINE, NINE CELL
138 = THE NUMBER OF TENS - COLUMN TEN - TEN, TEN CELL
139 = THE NUMBER OF TWOS - COLUMN TWO - TWO, TWO CELL
140 = QUESTIONS ASKED FOLLOWED BY SILENCE OR CONFUSION - FOUR, TEN CELL
141 = EXTENDED LECTURE - FIVE, FIVE CELL
142 = EXTENDED STUDENT INITIATION - NINE, NINE CELL
143 = THE NUMBER OF QUESTIONS ASKED
144 = FLEXIBILITY AS DEFINED BY GEORGE L. MILLER 4209 U.H.S., UNIVERSITY OF MICHIGAN
145 = THE NUMBER OF DIRECTIONS - COLUMN SIX - SIX, SIX CELL
146 = THE NUMBER OF TIMES A TEACHER ACCEPTS STUDENT'S IDEAS - COLUMN THREE - THREE, THREE CELL

NOTE:
THE PRECEDING LIST OF VARIABLES SHOULD BE INTERPRETED WITH CAUTION. AN UNDERSTANDING OF WHAT THE CATEGORIES ARE AND HOW THE MATRIX WORKS SHOULD BE ACQUIRED BEFORE ANY INTERPRETATION IS ATTEMPTED. IT SHOULD ALSO BE NOTED THAT THESE VARIABLES ARE NOT INDEPENDENT OF EACH OTHER. THE ABOVE VARIABLES HAVE BEEN DEFINED BY THOMAS SAMPH.

APPENDIX C

AN EXAMPLE OF A CONSULTANT'S INTERACTION WITH A COMPUTER SYSTEM WHILE EMPLOYING THE INTERACTION ANALYSIS DATA CLEAN-UP PROGRAM AND THE INTERACTION ANALYSIS MATRIX PROGRAM

(The lines beginning with an ✕ have been typed by the consultant. Instructions to type all other lines have come from the computer system.)

```
  UNIVERSITY OF MICHIGAN COMPUTING CENTER: ANN ARBOR (LA14-023)
  WHO ARE YOU?
  #
  LINE DELETED
*#SSIGNON SG01 PW=ARIJA
  #THE DISK SPACE ALLOTTED THIS USER ID HAS BEEN EXCEEDED.
  #**LAST SIGNON WAS: 20:00.33   06-06-68
  #  USER "SG01" SIGNED ON AT  09:19.16 ON 06-11-68
*#$CET DAT
  LINE DELETED
*#$GET DAT
  #READY.
*#$GET TEM
  #READY.
*#$GET FUS
  #READY.
*#$GET -DONE
  #READY.
*#1.0002
*#$RUN TEM -LIST 7=-DONE 1=FUS 6=*SINK*
  #EXECUTION BEGINS

   DATA SET WITH TITLE
        999999999999999999999
           000
        WITH   374SINGLE DIGIT TALLIES IS LOCATED AT RECORD NO.
            2: EACH CODE HAS 2DIGITS

   DATA SET WITH TITLE
        333333733333333333
           000
        WITH   177SINGLE DIGIT TALLIES IS LOCATED AT RECORD NO.
           10: EACH CODE HAS 3DIGITS

   DATA SET WITH TITLE
        3333333333733333333333
           000
        WITH   921SINGLE DIGIT TALLIES IS LOCATED AT RECORD NO.
           15; EACH CODE HAS 3DIGITS

   DATA SET WITH TITLE
        22222222222222222222
           000
        WITH   306SINGLE DIGIT TALLIES IS LOCATED AT RECORD NO.
           31; EACH CODE HAS 2DIGITS

   DATA SET WITH TITLE
        22212221223122221
           000
        WITH   176SINGLE DIGIT TALLIES IS LOCATED AT RECORD NO.
           38: EACH CODE HAS 2DIGITS
```

```
    DATA SET WITH TITLE
         333333333333333333333
            000
         WITH   990SINGLE DIGIT TALLIES IS LOCATED AT RECORD NO.
            43; EACH CODE HAS 3DIGITS

    DATA SET WITH TITLE
         333333333333333333333
            000
         WITH   177SINGLE DIGIT TALLIES IS LOCATED AT RECORD NO.
            60; EACH CODE HAS 3DIGITS

    DATA SET WITH TITLE
         222222222222222222222
            001
         WITH   730SINGLE DIGIT TALLIES IS LOCATED AT RECORD NO.
            65; EACH CODE HAS 2DIGITS
  IHC002I STOP       0  ***** RESTART AT LOCATION  1154E6
 #EXECUTION TERMINATED
*#SRUN DAT -LIST 7=-DONE 6=*SINK* 5=*MSOURCE*
 #EXECUTION BEGINS



    TYPE THE SPECIFICATION FOR IL (E.G. 0002)
*0065

    TYPE THE SPECIFICATION FOR IFIEL(E.G. 4)
*2

    TYPE THE SPECIFICATION FOR JCONT(E.G. 1)
*1

    TYPE THE SPECIFICATION FOR IMATRI(E.G. 1)
*1

    TYPE THE SPECIFICATION FOR IRELF(E.G. 2)
*1

    TYPE THE FORMAT THAT IS TO BE USED TO READ THE DATA
      START IN COLUMN ONE; USE I-FIELDS FOR CODES TO BE READ AND
      X FOR FIELDS TO BE SKIPPED; E.G.,(33(I1,1X))
*(3312)

    FORMAT USED TO READ THE RECORDS IN THE DATA FILE
    (3312)

    TYPE THE SPECIFICATION FOR NECOD (E.G. 10 OR 08)
*09
```

```
  TYPE THE SPECIFICATION FOR ICOLAP;
       TWO COLUMNS SHOULD BE USED (E.G.00,01,OR-1)
x-1

  TYPE THE SPECIFICATION FOR IA(THE CATEGORIES
          TO APPEAR IN THE OUTPUT)(E.G. 001 003 008 010 011 555);
  IMPORTANT: IN EACH OF THE LINES THE CODES SHOULD
  START IN THE SECOND COLUMN;
  DO NOT TYPE MORE THAN 10 CODES ON ONE LINE
  IF YOU USE MORE THAN 10 CODES, TYPE ON EACH LINE EXACTLY
  10 CODES EXCEPT ON THE LAST LINE;EACH CODE SHOULD
  CONSIST OF THREE DIGITS, A SPACE BETWEEN EACH CODE
x 031 032 033 034 081 082 091 092 000

  DATA USED HAS TITLE
  22222222222222222222
          001              WITH   730 SINGLE DIGIT CODES

  CATEGORIES IN WHICH THE  CODES  ARE  PLACED  FOR THIS PART OF THE DATA
    31  32  33  34  81  82  91  92   0

  IF AT THIS POINT YOU WISH TO HAVE THE SEQUENCE          OF TALLIES
  PRINTED OUT WITH REINTERPRETATIONS (IF ANY              WERE SPECIFIED), T
  1, OTHERWISE TYPE 0                                          TYPE
x1



  22222222222222222222
           001      ; TOTAL NUMBER OF TALLIESIS  365
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0 92 92 91 91 92
  92 92 92 92 92 92 92 92 91 91 91  0  0  0  0  0  0 81 81  0
   0 91 91  0  0 92 92  0  0  0  0  0  0 92 92 92 92 92 92 92
  92 91  0  0  0  0  0 82 82  0  0  0 92 92 92 92 92 92 92 92
   0  0  0  0  0 92 92 92 92 92  0  0 81 81 32 32  0  0  0  0
  81 81 82 91 91 32 32 34 34 34  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0 82 82 82  0  0  0  0  0 91 91 91  0  0 91 91
  91 91  0  0 34 34 32 81 81 81  0  0  0  0  0  0  0  0  0  0
  91 92 92  0  0  0  0  0  0  0  0  0  0  0  0  0 92 92 92 92
   0  0  0  0  0 92 92  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0 82 82 82 31 82 82 82 32 32 32 34 34 34 34  0
   0  0  0  0  0  0  0  0  0  0 91 91 91  0 31  0  0  0  0  0
   0  0  0 81 81 81 81 33 33 33  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0 92 92 92 92 92
  92 92 92  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0 81  0 81  0 81  0 81 81  0 81  0  0 81 81 82  0  0 34
  34 34  0  0  0  0  0  0  0  0  0  0  0 92 92 91 91 91 91 91
   0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
   0  0  0  0  0
```

22222222222222222222
FREQUENCY MATRIX

CAT	31	32	33	34	81	82	91	92	0	
31	0	0	0	0	0	1	0	0	1	2
32	0	4	0	2	1	0	0	0	1	8
33	0	0	2	0	0	0	0	0	1	3
34	0	1	0	8	0	0	0	0	3	12
81	0	1	1	0	10	2	0	0	7	21
82	1	1	0	0	0	7	1	0	3	13
91	0	1	0	0	0	0	16	2	7	26
92	0	0	0	0	0	0	4	41	7	52
0	1	0	0	2	10	3	5	9	197	227
TOT	2	8	3	12	21	13	26	52	227	364

22222222222222222222
RELATIVE FREQUENCY MATRIX

CAT	31	32	33	34	81	82	91	92	0	
31	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.5
32	0.0	1.1	0.0	0.5	0.3	0.0	0.0	0.0	0.3	2.2
33	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.3	0.8
34	0.0	0.3	0.0	2.2	0.0	0.0	0.0	0.0	0.8	3.3
81	0.0	0.3	0.3	0.0	2.7	0.5	0.0	0.0	1.9	5.8
82	0.3	0.3	0.0	0.0	0.0	1.9	0.3	0.0	0.8	3.6
91	0.0	0.3	0.0	0.0	0.0	0.0	4.4	0.5	1.9	7.1
92	0.0	0.0	0.0	0.0	0.0	0.0	1.1	11.3	1.9	14.3
0	0.3	0.0	0.0	0.5	2.7	0.8	1.4	2.5	54.1	62.4
TOT	0.5	2.2	0.8	3.3	5.8	3.6	7.1	14.3	62.4	100.0

TYPE THE SPECIFICATION FOR II. (E.G. 0002)
* 0015

TYPE THE SPECIFICATION FOR JFIEL(E.G. 4)
* 3

```
   TYPE THE SPECIFICATION FOR JCONT(E.G. 1)
*1

   TYPE THE SPECIFICATION FOR IMATRI(E.G. 1)
*1

   TYPE THE SPECIFICATION FOR IRELF(E.G. 2)
*0

   TYPE THE FORMAT THAT IS TO BE USED TO READ THE DATA
     START IN COLUMN ONE; USE I-FIELDS FOR CODES TO BE READ AND
     X FOR FIELDS TO BE SKIPPED; E.G.,(33(I1,1X))
*(22(1X,2
LINE DELETED
*(22(1X,I2))

   FORMAT USED TO READ THE RECORDS IN THE DATA FILE
   (22(1X,I2))

   TYPE THE SPECIFICATION FOR NECOD (E.G. 10 OR 08)
*11

   TYPE THE SPECIFICATION FOR ICOLAP;
        TWO COLUMNS SHOULD BE USED (E.G.00,01,OR-1)
*-1

   TYPE THE SPECIFICATION FOR IA(THE CATEGORIES
          TO APPEAR IN THE OUTPUT)(E.G. 001 003 008 010 011 555);
   IMPORTANT: IN EACH OF THE LINES THE CODES SHOULD
   START IN THE SECOND COLUMN;
   DO NOT TYPE MORE THAN 10 CODES ON ONE LINE
   IF YOU USE MORE THAN 10 CODES, TYPE ON EACH LINE EXACTLY
   10 CODES EXCEPT ON THE LAST LINE;EACH CODE SHOULD
   CONSIST OF THREE DIGITS, A SPACE BETWEEN EACH CODE
* 011 012 013 014 015 021 022 023 024 025
* 000

   DATA USED HAS TITLE
   33333333333333333333
          000              WITH   921 SINGLE DIGIT CODES

   CATEGORIES IN WHICH THE  CODES  ARE  PLACED  FOR THIS PART OF THE DATA
*   11  12  13  14  15  21  22  23  24  25
*   0

   IF AT THIS POINT YOU WISH TO HAVE THE SEQUENCE          OF TALLIES
   PRINTED OUT WITH REINTERPRETATIONS (IF ANY          WERE SPECIFIED), T
   1, OTHERWISE TYPE 0
*0
```

```
333333333333333333333                                                    00
FREQUENCY MATRIX

 CAT     11    12    13    14    15    21    22    23    24    25     0
  11     10     0     0     0     0     1     1     0     0     0     6    18
  12      0     7     4     0     0     0     0     0     0     0     4    15
  13      0     2    14     0     0     0     0     0     0     0     6    22
  14      0     1     0     3     0     0     0     0     0     0     3     7
  15      0     0     0     0     0     0     0     0     0     0     0     0
  21      0     0     0     0     0     5     0     0     0     0     1     6
  22      1     1     0     0     0     0     2     0     0     0     0     4
  23      0     0     0     0     0     0     0     0     0     0     0     0
  24      0     0     0     0     0     0     0     0     0     0     0     0
  25      0     0     0     0     0     0     0     0     0     0     0     0
   0      7     4     5     4     0     0     1     0     0     0   213   234
 TOT     18    15    23     7     0     6     4     0     0     0   233   306
```

```
   TYPE THE SPECIFICATION FOR IL (E.G. 0002)
*0015

   TYPE THE SPECIFICATION FOR IFIEL(E.G. 4)
*3

   TYPE THE SPECIFICATION FOR JCONT(E.G. 1)
*1

   TYPE THE SPECIFICATION FOR IMATRI(E.G. 1)
*1

   TYPE THE SPECIFICATION FOR IRELF(E.G. 2)
*0

   TYPE THE FORMAT THAT IS TO BE USED TO READ THE DATA
     START IN COLUMN ONE; USE I-FIELDS FOR CODES TO BE READ AND
     X FOR FIELDS TO BE SKIPPED; E.G.,(33(I1,1X))
*(22(1X,2I))

   FORMAT USED TO READ THE RECORDS IN THE DATA FILE
   (22(1X,2I))

   TYPE THE SPECIFICATION FOR NECOD (E.G. 10 OR 08)
*1
LINE DELETED
*01
```

```
   TYPE THE SPECIFICATION FOR ICOLAP;
        TWO COLUMNS SHOULD BE USED (E.G.00,01,OR-1)
x -1

   TYPE THE SPECIFICATION FOR IA(THE CATEGORIES
           TO APPEAR IN THE OUTPUT)(E.G. 001 003 008 010 011 555);
   IMPORTANT: IN EACH OF THE LINES THE CODES SHOULD
   START IN THE SECOND COLUMN;
   DO NOT TYPE MORE THAN 10 CODES ON ONE LINE
   IF YOU USE MORE THAN 10 CODES, TYPE ON EACH LINE EXACTLY
   10 CODES EXCEPT ON THE LAST LINE;EACH CODE SHOULD
   CONSIST OF THREE DIGITS, A SPACE BETWEEN EACH CODE
x 000

   DATA USED HAS TITLE
   33333333333333333333
           000              WITH   921 SINGLE DIGIT CODES

   CATEGORIES IN WHICH THE  CODES  ARE  PLACED  FOR THIS PART OF THE DATA
      0

   IF AT THIS POINT YOU WISH TO HAVE THE SEQUENCE          OF TALLIES
   PRINTED OUT WITH REINTERPRETATIONS (IF ANY          WERE SPECIFIED), T
   1, OTHERWISE TYPE 0
x 0



   33333333333333333333                                              00
   FREQUENCY MATRIX

   CAT      0.
     0    306  306
   TOT    306  306



   TYPE THE SPECIFICATION FOR IL (E.G. 0002)
x 0015

   TYPE THE SPECIFICATION FOR IFIEL(E.G. 4)
x 3

   TYPE THE SPECIFICATION FOR JCONI(E.G. 1)
x 1
```

```
  TYPE THE SPECIFICATION FOR IMATRI(E.G. 1)
*1

  TYPE THE SPECIFICATION FOR IRELF(E.G. 2)
*0

  TYPE THE FORMAT THAT IS TO BE USED TO READ THE DATA
    START IN COLUMN ONE; USE I-FIELDS FOR CODES TO BE READ AND
    X FOR FIELDS TO BE SKIPPED; E.G.,(33(I1,1X))
*(22(1X,I2))

  FORMAT USED TO READ THE RECORDS IN THE DATA FILE
  (22(1X,I2))

  TYPE THE SPECIFICATION FOR NECOD (E.G. 10 OR 08)
*12

  TYPE THE SPECIFICATION FOR ICOLAP;
      TWO COLUMNS SHOULD BE USED (E.G.00,01,OR-1)
*-1

  TYPE THE SPECIFICATION FOR IA(THE CATEGORIES
          TO APPEAR IN THE OUTPUT)(E.G. 001 003 008 010 011 555);
  IMPORTANT: IN EACH OF THE LINES THE CODES SHOULD
  START IN THE SECOND COLUMN;
  DO NOT TYPE MORE THAN 10 CODES ON ONE LINE
  IF YOU USE MORE THAN 10 CODES, TYPE ON EACH LINE EXACTLY
  10 CODES EXCEPT ON THE LAST LINE;EACH CODE SHOULD
  CONSIST OF THREE DIGITS, A SPACE BETWEEN EACH CODE
* 031 032 033 034 035 041 042 043 044 045
* 099 00

  DATA USED HAS TITLE
  33333333333333333333
        000              WITH   921 SINGLE DIGIT CODES

  CATEGORIES IN WHICH THE  CODES  ARE  PLACED  FOR THIS PART OF THE DATA
    31   32   33   34   35   41   42   43   44   45
    99    0

  IF AT THIS POINT YOU WISH TO HAVE THE SEQUENCE          OF TALLIES
  PRINTED OUT WITH REINTERPRETATIONS (IF ANY          WERE SPECIFIED), T
  1, OTHERWISE TYPE 0
*0
```

```
333333333333333333333
FREQUENCY MATRIX                                                        00

 CAT    31   32   33   34   35   41   42   43   44   45   99    0
  31    19    0    1    0    0    0    0    0    0    0    4    9    33
  32     1    0    0    0    0    0    0    0    1    0    0    0     2
  33     1    1    2    0    0    0    0    0    0    0    0    2     6
  34     0    0    0    0    0    0    0    0    0    0    1    0     1
  35     0    0    0    0    0    0    0    0    0    0    0    0     0
  41     0    0    0    0    0    3    0    0    0    0    0    1     4
  42     1    0    0    0    0    0    0    0    0    0    1    0     2
  43     1    0    0    0    0    0    0    0    0    0    1    0     2
  44     1    0    0    0    0    0    0    0    1    1    0    0     3
  45     0    0    1    0    0    0    0    0    0    3    0    1     5
  99     3    0    1    1    0    1    0    1    1    0   70   18    96
   0     6    1    1    0    0    0    2    1    0    1   19  121   152
 TOT    33    2    6    1    0    4    2    2    3    5   96  152   305
```

```
   TYPE THE SPECIFICATION FOR IL (E.G. 0002)
*0015

   TYPE THE SPECIFICATION FOR IFIEL(E.G. 4)
*3

   TYPE THE SPECIFICATION FOR JCONT(E.G. 1)
*1

   TYPE THE SPECIFICATION FOR IMATRI(E.G. 1)
*1

   TYPE THE SPECIFICATION FOR IRELF(E.G. 2)
*0

   TYPE THE FORMAT THAT IS TO BE USED TO READ THE DATA
     START IN COLUMN ONE; USE I-FIELDS FOR CODES TO BE READ AND
     X FOR FIELDS TO BE SKIPPED; E.G.,(33(I1,1X))
*(22I3)

   FORMAT USED TO READ THE RECORDS IN THE DATA FILE
   (22I3)

   TYPE THE SPECIFICATION FOR NECOD (E.G. 10 OR 08)
*08

   TYPE THE SPECIFICATION FOR ICOLAP;
        TWO COLUMNS SHOULD BE USED (E.G.00,01,OR-1)
*-1
```

```
   TYPE THE SPECIFICATION FOR IA(THE CATEGORIES
          TO APPEAR IN THE OUTPUT)(E.G. 001 003 008 010 011 555);
   IMPORTANT: IN EACH OF THE LINES THE CODES SHOULD
   START IN THE SECOND COLUMN;
   DO NOT TYPE MORE THAN 10 CODES ON ONE LINE
   IF YOU USE MORE THAN 10 CODES, TYPE ON EACH LINE EXACTLY
   10 CODES EXCEPT ON THE LAST LINE;EACH CODE SHOULD
   CONSIST OF THREE DIGITS, A SPACE BETWEEN EACH CODE
x 231 331 431 631 731 831 931 000

   DATA USED HAS TITLE
   33333333333333333333
          000              WITH   921 SINGLE DIGIT CODES

   CATEGORIES IN WHICH THE  CODES  ARE  PLACED  FOR THIS PART OF THE DATA
    231 331 431 631 731 831 931   0

   IF AT THIS POINT YOU WISH TO HAVE THE SEQUENCE          OF TALLIES
   PRINTED OUT WITH REINTERPRETATIONS (IF ANY          WERE SPECIFIED), T
   1, OTHERWISE TYPE 0
x0
```

```
   333333333333333333333
   FREQUENCY MATRIX                                                    00

   CAT    231   331   431   631   731   831   931     0
   231      0     0     0     0     0     0     0     1     1
   331      0     0     0     0     0     0     0     1     1
   431      0     0     2     0     0     3     0     2     7
   631      0     0     0     0     0     0     0     0     0
   731      0     0     0     0     0     0     0     0     0
   831      1     0     0     0     0     5     0     5    11
   931      0     1     1     0     0     0     5     5    12
     0      0     0     4     0     0     3     7   260   274
   TOT      1     1     7     0     0    11    12   274   306
```

```
   TYPE THE SPECIFICATION FOR IL (E.G. 0002)
x 0015

   TYPE THE SPECIFICATION FOR IFIEL(E.G. 4)
x 3
```

```
  TYPE THE SPECIFICATION FOR JCONT(E.G. 1)
*1

  TYPE THE SPECIFICATION FOR IMATRI(E.G. 1)
*1

  TYPE THE SPECIFICATION FOR IRELF(E.G. 2)
*1

  TYPE THE FORMAT THAT IS TO BE USED TO READ THE DATA
    START IN COLUMN ONE; USE I-FIELDS FOR CODES TO BE READ AND
    X FOR FIELDS TO BE SKIPPED; E.G.,(33(I1,1X))
*(22(I1,2X))

  FORMAT USED TO READ THE RECORDS IN THE DATA FILE
  (22(I1,2X))

  TYPE THE SPECIFICATION FOR NECOD (E.G. 10 OR 08)
*09

  TYPE THE SPECIFICATION FOR ICOLAP;
       TWO COLUMNS SHOULD BE USED (E.G.00,01,OR-1)
*-1

  TYPE THE SPECIFICATION FOR IA(THE CATEGORIES
       TO APPEAR IN THE OUTPUT)(E.G. 001 003 008 010 011 555);
  IMPORTANT: IN EACH OF THE LINES THE CODES SHOULD
  START IN THE SECOND COLUMN;
  DO NOT TYPE MORE THAN 10 CODES ON ONE LINE
  IF YOU USE MORE THAN 10 CODES, TYPE ON EACH LINE EXACTLY
  10 CODES EXCEPT ON THE LAST LINE;EACH CODE SHOULD
  CONSIST OF THREE DIGITS, A SPACE BETWEEN EACH CODE
* 002 003 004 005 006 007 008 009 000

  DATA USED HAS TITLE
  33333333333333333333
          000              WITH   921 SINGLE DIGIT CODES

  CATEGORIES IN WHICH THE  CODES  ARE  PLACED  FOR THIS PART OF THE DATA
     2   3   4   5   6   7   8   9   0

  IF AT THIS POINT YOU WISH TO HAVE THE SEQUENCE              OF TALLIES
  PRINTED OUT WITH REINTERPRETATIONS (IF ANY                 WERE SPECIFIED), T
  1, OTHERWISE TYPE 0
*0
```

33333333333333333333
FREQUENCY MATRIX

00

CAT	2	3	4	5	6	7	8	9	0	
2	0	0	6	0	0	0	1	1	0	8
3	0	3	4	2	0	0	1	4	2	16
4	0	1	20	0	0	0	29	6	2	58
5	0	0	6	17	2	1	1	2	0	29
6	0	0	0	0	1	0	1	3	0	5
7	0	0	0	2	0	1	1	1	1	6
8	6	7	14	2	0	2	32	11	1	75
9	2	6	6	4	2	1	7	34	2	64
0	0	0	2	1	0	1	2	2	37	45
TOT	8	17	58	28	5	6	75	64	45	306

33333333333333333333
RELATIVE FREQUENCY MATRIX

00

CAT	2	3	4	5	6	7	8	9	0	
2	0.0	0.0	2.0	0.0	0.0	0.0	0.3	0.3	0.0	2.6
3	0.0	1.0	1.3	0.7	0.0	0.0	0.3	1.3	0.7	5.2
4	0.0	0.3	6.5	0.0	0.0	0.0	9.5	2.0	0.7	19.0
5	0.0	0.0	2.0	5.6	0.7	0.3	0.3	0.7	0.0	9.5
6	0.0	0.0	0.0	0.0	0.3	0.0	0.3	1.0	0.0	1.6
7	0.0	0.0	0.0	0.7	0.0	0.3	0.3	0.3	0.3	2.0
8	2.0	2.3	4.6	0.7	0.0	0.7	10.5	3.6	0.3	24.5
9	0.7	2.0	2.0	1.3	0.7	0.3	2.3	11.1	0.7	20.9
0	0.0	0.0	0.7	0.3	0.0	0.3	0.7	0.7	12.1	14.7
TOT	2.6	5.6	19.0	9.2	1.6	2.0	24.5	20.9	14.7	100.0

TYPE THE SPECIFICATION FOR IL (E.G. 0002)
*0015

TYPE THE SPECIFICATION FOR IFIEL(E.G. 4)
*3

TYPE THE SPECIFICATION FOR JCONT(E.G. 1)
*1

TYPE THE SPECIFICATION FOR IMATRI(E.G. 1)
*1

```
  TYPE THE SPECIFICATION FOR IRELF(E.G. 2)
*0

  TYPE THE FORMAT THAT IS TO BE USED TO READ THE DATA
    START IN COLUMN ONE; USE I-FIELDS FOR CODES TO BE READ AND
    X FOR FIELDS TO BE SKIPPED; E.G.,(33(I1,1X))
*(22(1X,I2))

  FORMAT USED TO READ THE RECORDS IN THE DATA FILE
  (22(1X,I2))

  TYPE THE SPECIFICATION FOR NECOD (E.G. 10 OR 08)
*06

  TYPE THE SPECIFICATION FOR ICOLAP;
       TWO COLUMNS SHOULD BE USED (E.G.00,01,OR-1)
*-1

  TYPE THE SPECIFICATION FOR IA(THE CATEGORIES
         TO APPEAR IN THE OUTPUT)(E.G. 001 003 008 010 011 555);
  IMPORTANT: IN EACH OF THE LINES THE CODES SHOULD
  START IN THE SECOND COLUMN;
  DO NOT TYPE MORE THAN 10 CODES ON ONE LINE
  IF YOU USE MORE THAN 10 CODES, TYPE ON EACH LINE EXACTLY
  10 CODES EXCEPT ON THE LAST LINE;EACH CODE SHOULD
  CONSIST OF THREE DIGITS, A SPACE BETWEEN EACH CODE
* 011 012 013 031 099 000

  DATA USED HAS TITLE
  333333333333333333333
          000            WITH   921 SINGLE DIGIT CODES

  CATEGORIES IN WHICH THE  CODES  ARE  PLACED  FOR THIS PART OF THE DATA
    11  12  13  31  99   0

  IF AT THIS POINT YOU WISH TO HAVE THE SEQUENCE          OF TALLIES
  PRINTED OUT WITH REINTERPRETATIONS (IF ANY          WERE SPECIFIED), T
  1, OTHERWISE TYPE 0
*1
```

```
333333333333333333333
          000      ; TOTAL NUMBER OF TALLIESIS  307
  0 99 99 99  0 99 99  0 99 99 99 99 99 99 99 99 99 99 31 31
 99 99 99  0 99 99 99 99 99 99 99 99  0  0  0  0  0  0 31 31
 31 99  0  0  0  0  0  0  0  0 99 99 99 99 99 99 99 99 99 99
 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99 99
 99 99 99 99 99  0 99 99  0  0 99  0  0  0  0  0 12 31  0  0
 31 31  0  0  0  0 99  0  0  0  0  0  0  0 31 31 31 31 31 11
 11 11 11 11  0  0  0  0  0 99 99  0  0  0  0  0 99  0 99 99
  0 12 31  0  0  0  0 31 31  0  0  0  0  0  0  0  0 99 99 99
 99 31 31 31 31 31 99 99 99  0  0  0  0  0  0 99  0  0  0  0
  0  0  0  0  0  0 11 11  0 99 99 31 31 31  0  0  0  0 99 13

 13  0 13  0 12 13 13 12 12 13 99 99  0  0 11 11  0  0  0  0
  0  0 31  0  0 99  0 31 31 31 31 31  0  0 11 11  0  0 13 13
 13 13  0  0  0  0 11 11 99  0 11 11 11  0 31 11  0  0  0  0
 12  0 12 12 12 12 12 99 99 99 99 99  0 99  0  0 31  0 13 12
 12 12 13 13 13 13 13 13 13 13  0 31 99  0  0  0 99 99 13 99
 11  0  0 12 13 13 13
```

```
333333333333333333333
FREQUENCY MATRIX

CAT      11    12    13    31    99     0
 11      10     0     0     0     1     7    18
 12       0     7     4     2     1     1    15
 13       0     2    14     0     2     4    22
 31       2     0     0    19     4     8    33
 99       1     0     2     3    70    20    96
  0       5     6     3     9    13    81   122
TOT      18    15    23    33    96   121   306
```

00

```
   TYPE THE SPECIFICATION FOR IL (E.G. 0002)
*0015

   TYPE THE SPECIFICATION FOR IFIEL(E.G. 4)
*3

   TYPE THE SPECIFICATION FOR JCONT(E.G. 1)
*1
```

```
  TYPE THE SPECIFICATION FOR IMATRI(E.G. 1)
*0

  TYPE THE SPECIFICATION FOR IRELF(E.G. 2)
*1

  TYPE THE FORMAT THAT IS TO BE USED TO READ THE DATA
    START IN COLUMN ONE; USE I-FIELDS FOR CODES TO BE READ AND
    X FOR FIELDS TO BE SKIPPED; E.G.,(33(I1,1X))
*(22(I1,2X))

  FORMAT USED TO READ THE RECORDS IN THE DATA FILE
  (22(I1,2X))

  TYPE THE SPECIFICATION FOR NECOD (E.G. 10 OR 08)
*00

  TYPE THE SPECIFICATION FOR ICOLAP;
       TWO COLUMNS SHOULD BE USED (E.G.00,01,OR-1)
*01

  TYPE THE SPECIFICATION FOR NCOL(E.G. 08 OR 12)
*02

  TYPE THE SPECIFICATION FOR IA(THE CATEGORIES
         TO APPEAR IN THE OUTPUT)(E.G. 001 003 008 010 011 555);
  IMPORTANT: IN EACH OF THE LINES THE CODES SHOULD
  START IN THE SECOND COLUMN;
  DO NOT TYPE MORE THAN 10 CODES ON ONE LINE
  IF YOU USE MORE THAN 10 CODES, TYPE ON EACH LINE EXACTLY
  10 CODES EXCEPT ON THE LAST LINE;EACH CODE SHOULD
  CONSIST OF THREE DIGITS, A SPACE BETWEEN EACH CODE
* 002 003 004 005 006 007 008 009 000

  DATA USED HAS TITLE
  333333333333333333333
          000              WITH   921 SINGLE DIGIT CODES

  CATEGORIES IN WHICH THE  CODES  ARE  PLACED  FOR THIS PART OF THE DATA
     2   3   4   5   6   7   8   9   0

  TYPE THE SPECIFICATION OF THE COLLAPSING
              SCHEME BY USING PAIRS OF 4 DIGIT CODES WHERE THE
               SECOND CODE IS TO BE REPLACED BY THE FIRST CODE
                (E.G. 00010003 00010012) SKIP A SPACE BETWEEN EACH SET
           OF 2 CODES.  DO NOT TYPE MORE THAN 4 PAIRS OF CODES
              ON ONE LINE
* 00100001

  PAIRS OF CATEGORIES, WHERE THE SECOND CODE OF THE PAIR IS PLACED INTO
   CATEGORY REPRESENTED BY THE FIRST CODE
     10    1
```

```
   IF AT THIS POINT YOU WISH TO HAVE THE SEQUENCE          OF TALLIES
   PRINTED OUT WITH REINTERPRETATIONS (IF ANY             WERE SPECIFIED), T
   1, OTHERWISE TYPE 0
*0

3333333333333333333
RELATIVE FREQUENCY MATRIX                                              00

CAT     2     3     4     5     6     7     8     9     0
  2   0.0   0.0   2.4   0.0   0.0   0.0   0.4   0.4   0.0   3.2
  3   0.0   1.2   1.6   0.8   0.0   0.0   0.4   1.6   0.0   5.5
  4   0.0   0.4   7.9   0.0   0.0   0.0  11.5   2.4   0.0  22.1
  5   0.0   0.0   2.4   6.7   0.8   0.4   0.4   0.8   0.0  11.5
  6   0.0   0.0   0.0   0.0   0.4   0.0   0.4   1.2   0.0   2.0
  7   0.0   0.0   0.0   0.8   0.0   0.4   0.4   0.4   0.0   2.0
  8   2.4   2.8   5.5   0.8   0.0   0.8  12.6   4.3   0.0  29.2
  9   0.8   2.4   2.4   1.6   0.8   0.4   2.8  13.4   0.0  24.5
  0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
TOT   3.2   6.7  22.1  10.7   2.0   2.0  28.9  24.5   0.0100.0


   TYPE THE SPECIFICATION FOR IL (E.G. 0002)
*0015

   TYPE THE SPECIFICATION FOR IFIEL(E.G. 4)
*3

   TYPE THE SPECIFICATION FOR JCONT(E.G. 1)
*1

   TYPE THE SPECIFICATION FOR IMATRI(E.G. 1)
*0

   TYPE THE SPECIFICATION FOR IRELF(E.G. 2)
*1

   TYPE THE FORMAT THAT IS TO BE USED TO READ THE DATA
     START IN COLUMN ONE; USE I-FIELDS FOR CODES TO BE READ AND
     X FOR FIELDS TO BE SKIPPED; E.G.,(33(I1,1X))
*(22(I1,2X))

   FORMAT USED TO READ THE RECORDS IN THE DATA FILE
   (22(I1,2X))
```

```
   TYPE THE SPECIFICATION FOR NECOD (E.G. 10 OR 08)
*10

   TYPE THE SPECIFICATION FOR ICOLAP;
        TWO COLUMNS SHOULD BE USED (E.G.00,01,OR-1)
*01

   TYPE THE SPECIFICATION FOR NCOL(E.G. 08 OR 12)
*02

   TYPE THE SPECIFICATION FOR IA(THE CATEGORIES
           TO APPEAR IN THE OUTPUT)(E.G. 001 003 008 010 011 555);
   IMPORTANT: IN EACH OF THE LINES THE CODES SHOULD
   START IN THE SECOND COLUMN;
   DO NOT TYPE MORE THAN 10 CODES ON ONE LINE
   IF YOU USE MORE THAN 10 CODES, TYPE ON EACH LINE EXACTLY
   10 CODES EXCEPT ON THE LAST LINE;EACH CODE SHOULD
   CONSIST OF THREE DIGITS, A SPACE BETWEEN EACH CODE
* 002 003 004 005 006 007 008 009 010 000

   DATA USED HAS TITLE
   33333333333333333333
           000              WITH   921 SINGLE DIGIT CODES

   CATEGORIES IN WHICH THE  CODES  ARE  PLACED  FOR THIS PART OF THE DATA
      2   3   4   5   6   7   8   9  10   0

   TYPE THE SPECIFICATION OF THE COLLAPSING
                SCHEME BY USING PAIRS OF 4 DIGIT CODES WHERE THE
                 SECOND CODE IS TO BE REPLACED BY THE FIRST CODE
                  (E.G. 00010003 00010012) SKIP A SPACE BETWEEN EACH SE
             OF 2 CODES.  DO NOT TYPE MORE THAN 4 PAIRS OF CODES
                ON ONE LINE
*00100001

   PAIRS OF CATEGORIES, WHERE THE SECOND CODE OF THE PAIR IS PLACE
    CATEGORY REPRESENTED BY THE FIRST CODE
      10    1

   IF AT THIS POINT YOU WISH TO HAVE THE SEQUENCE          OF TALLIES
   PRINTED OUT WITH REINTERPRETATIONS (IF ANY          WERE SPECIFIE
   1, OTHERWISE TYPE 0
*0
```

3333333333333333333

00

RELATIVE FREQUENCY MATRIX

CAT	2	3	4	5	6	7	8	9	10	0	
2	0.0	0.0	2.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	2.6
3	0.0	1.0	1.3	0.7	0.0	0.0	0.3	1.3	0.7	0.0	5.2
4	0.0	0.3	6.5	0.0	0.0	0.0	9.5	2.0	0.7	0.0	19.0
5	0.0	0.0	2.0	5.6	0.7	0.3	0.3	0.7	0.0	0.0	9.5
6	0.0	0.0	0.0	0.0	0.3	0.0	0.3	1.0	0.0	0.0	1.6
7	0.0	0.0	0.0	0.7	0.0	0.3	0.3	0.3	0.3	0.0	2.0
8	2.0	2.3	4.6	0.7	0.0	0.7	10.5	3.6	0.3	0.0	24.5
9	0.7	2.0	2.0	1.3	0.7	0.3	2.3	11.1	0.7	0.0	20.9
10	0.0	0.0	0.7	0.3	0.0	0.3	0.7	0.7	12.1	0.0	14.7
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOT	2.6	5.6	19.0	9.2	1.6	2.0	24.5	20.9	14.7	0.0	100.0

```
   TYPE THE SPECIFICATION FOR IL (E.G. 0002)
*  -1
 IHC002I STOP      0  ***** RESTART AT LOCATION  111FA2
*EXECUTION TERMINATED
```

APPENDIX D

A 22 CATEGORY SYSTEM BASED ON FLANDERS' 10 CATEGORIES

Level Category	1	2	3	4
2	Superficial encouragement like "um hm" and expressions like "right", "good", etc.	Longer praise statements, often explaining praise. Most genuine. Kid really hears it.	Same as Category 1 in Appendix A.	
3	Merely repetition superficial recognition of student's idea.	Student's idea is developed (or used) by teacher as seen by teacher.	Student's idea is developed by teacher in terms of other pupil ideas or compares to other pupil ideas.	Asks questions in levels 2 or 3.
4	Narrow factual questions, e.g., What? Where? When? and other questions emphasizing recall.	Broad, general, open questions which clearly permit a choice of response. Asks opinion.		
5	Narrow, factual focus. Restricted concepts & purpose. Low level in terms of reasoning.	Not level (1) and not level (3).	Negative and critical, but not "7". Disagrees without comment or explanation.	
6	Narrow commands to which compliance is expected and can be easily judged.	Explains his directions and how something is to be done.	Provides alternatives, reasons, invites students to help decide what must be done next.	
7	Same as Category 7 in Appendix A.			
8	Student responds by making a statement.	Student asks question in "tight" format along teacher's lines of thought.		
9	Student responses showing freedom of own ideas or simply taking the initiative in terms of talking.	Student asks questions showing freedom of student thought or initiative.		
1[a]	Non-constructive use of time.	Constructive use of time.		

0 is used as the separation code.

[a]Note that 1 is used in place of category 10 in the Flanders' Ten Categories.

APPENDIX E

COST ESTIMATES

Installation Costs

$ 47.00	Data set at the Oakland County Intermediate School District Computing Center.
$ 94.50	A private line, a telephone extension jack in each classroom of five classrooms, and the assembling of the parts for a touch telephone data set to be used with the telephone extension jacks in the five classrooms.
$141.50	Total

Monthly Costs

$ 21.85	Rental of a private telephone line and the touch telephone data set in a school building.
$ 7.00	Rental of four extension plugs.
$ 36.85	Rental of a data set at the Oakland County Intermediate School District Computing Center.
$120.00	Keypunch connected with the data set at the Oakland County Intermediate School District Computing Center.
$174.70	Total

Costs Not Included in the Above Estimates

Computer time needed to process data.
Manpower needed to operate the data collection and processing system.
Writing and improving of computer programs.
Training of staff to use the data collection and processing system.

LIST OF REFERENCES

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